

SCIENCE.

FRIDAY, MARCH 7, 1884.

COMMENT AND CRITICISM.

IN the rapid progress which animal morphology has been making in this country during the past few years, we doubt whether the vertebrates have had their due share of attention. With the exception of Cornell, we believe that the larger laboratories are turning their students principally to investigation among the invertebrates,—among this class, Cambridge and Baltimore. We do not for a moment under-estimate the immense value of this work, or the high standard it has attained; but are we not slighting the rare opportunities the United States afford for vertebrate research, and allowing it to be done by foreigners? To illustrate by a few examples out of many. In embryology the alligator and the urodele amphibia present the most important field of work. As regards the former, Professor Kitchen Parker of London has just completed a monograph upon the development of the skull, principally based upon American material. As regards the latter, is it not surprising, that, with an abundance of living specimens at ready command, the best work upon the angiology of the group is coming from Boas in Denmark; and upon the anatomy and embryology, from Wiedersheim and others in German laboratories; while here we have only to show a few current researches upon the neurology? Our large avian fauna invites the kind of systematic anatomical work which the late W. A. Forbes, and his predecessor as prosector, A. H. Garrod, undertook in the London zoölogical gardens. But there is another quarter where the harvest is still greater and the laborers fewer; that is, vertebrate paleontology. We can count upon the fingers of one hand the investigators in this magnificent field; yet there is enough work for several lifetimes in the fossils already exhumed, without mention of those which lie waiting the collecting-sack of the explorer.

HOWEVER just "Professor Rowland's vigorous denunciation of American science text-books" may be in respect to the sciences with which he is conversant, it need not be forgotten that in at least three departments of natural history this country has been seasonably provided, by its most competent hands, with text-books, which, for their purpose and scope, have not been surpassed in any other part of the world. It is a remarkable fact that two of them, Dana's Mineralogy and his Geology, are from the same hand.

THE suggestions regarding the preservation of our few important aboriginal monuments, made by the curator of the Peabody museum to its trustees at their recent annual meeting, is one that should excite general interest and attention. These monuments are fast disappearing under the plough and harrow, and many are further endangered by the growth of population in their neighborhood. As a rule, the land about them could be purchased of their present owners for comparatively small sums; and trusty keepers could be installed at no expense beyond the free lease of the reserves, with liberty to till such outlying portions as could do no harm to the monuments.

It would be eminently proper for the states in which these monuments exist to take efficient action for the preservation of the most important; but, if the states are likely to delay in the movement, the townships or local societies should at once secure the works from further destruction. These failing in immediate action, why cannot an association be formed for the purchase and care of ancient monuments; the association to hold them, until, by legislative action, each state shall take those within its borders under perpetual care? or perhaps it would prove the speediest and most satisfactory method of all, if persons specially interested in the preservation of certain of them

would combine to purchase the sites, and transfer the custody of the same to the trustees of the Peabody museum at Cambridge, which, as the only institution in the country specially devoted to American archeology, would be a fitting and safe almoner of such a trust.

A FEW months ago a piece of vandalism which shocked the scientific and artistic worlds was perpetrated in Munich. Some fiend took it into his head to disfigure the beautiful new marble statue of Liebig by staining it with a dark liquid. It was at first thought that it would be impossible to remove the stains, as they were found to have affected the marble to some depth beneath the surface. A commission of chemists, consisting of Professors von Pettenkopper and Baeyer, Liebig's successor, and Dr. Zimmermann, was appointed to investigate the matter, with a view to determine the nature of the stains, and to remove them if possible. It was found that nitrate of silver had been used, with which some permanganate of potassium had probably been mixed. It is gratifying to learn that the work of the commission has been entirely successful, the stains having been completely removed without injury of any kind to the statue. The method used consisted in transforming the metals, silver and manganese, into the sulphides by treating the spots with sulphide of ammonium, and then with cyanide of potassium. The chemicals were used in the form of pastes, made by mixing them with finely-powdered porcelain-clay.

GEN. TENNANT has recently called attention to a possible cause of variation in the rates of chronometers, which has never before been considered; namely, the humidity of the air. The subject is well worthy of investigation; and it is to be hoped that those interested in determining the rates of chronometers will also make observations on the humidity of the air around the chronometer, in order to determine whether any such effect is really produced. Gen. Tennant's results are not presented in such a form that a positive conclusion can be reached.

THE appointment of Professor Flower to succeed Sir Richard Owen as superintendent of the natural-history department of the British museum is as gratifying to American naturalists as it is to the majority of those in England. The removal of this section of the museum to the new building, South Kensington, will, of course, sever it still further from the control of the chief librarian, who is technically the head of the entire organization; while the new policy of making it an educational museum, as well as a museum of research and record, adds much to the responsibilities of its officers. Professor Owen, having brought his career as an active investigator to a wonderfully satisfactory conclusion, is glad to be relieved of administrative duties, and to retire to his country home near Richmond, to devote his few remaining years to quiet study. Professor Flower, who succeeded him as conservator of the museum of the Royal college of surgeons, has demonstrated in that capacity his ability as a museum director. His work as an investigator has been extensive and important; and there is no naturalist in England who is more deservedly popular, or who could command a more unanimous support among his fellow-workers. Seconded, as he is, by three such experienced assistants,—Dr. Gunther, keeper of the zoölogical collections; Dr. Woodward, keeper of the geological collections; and Dr. Carruthers, keeper of the botanical collections,—there can be no doubt that Professor Flower will be able to add very much to the efficiency of what is already the most extensive natural-history museum in existence.

WE referred, a few weeks since, to the favorable opportunity now afforded for observations upon Saturn. At the January meeting of the Royal astronomical society of London, there was an interesting discussion upon the markings upon the planet observed by Mr. Pratt of Brighton, and other members of the society. The planet was described as having on each side of its equator a zone of creamy tint, unusually free from markings. At about latitude 10° south, there was a strong narrow belt sharp-

ly defined on its equatorial side, diffused upon its polar side, and gathered in places into wispy notches and curved markings. The color was a vandyke brown. Several other belts of different tints were interposed between this one and the pole. Other observers mention the existence of loops somewhat resembling the markings on Jupiter. The planet is now too far past its opposition to be well observed during the present season; but the opposition of December next will be yet more favorable for observations, and will, we hope, be taken advantage of by all possessors of telescopes.

LETTERS TO THE EDITOR.

*** Correspondents are requested to be as brief as possible. The writer's name is in all cases required as proof of good faith.*

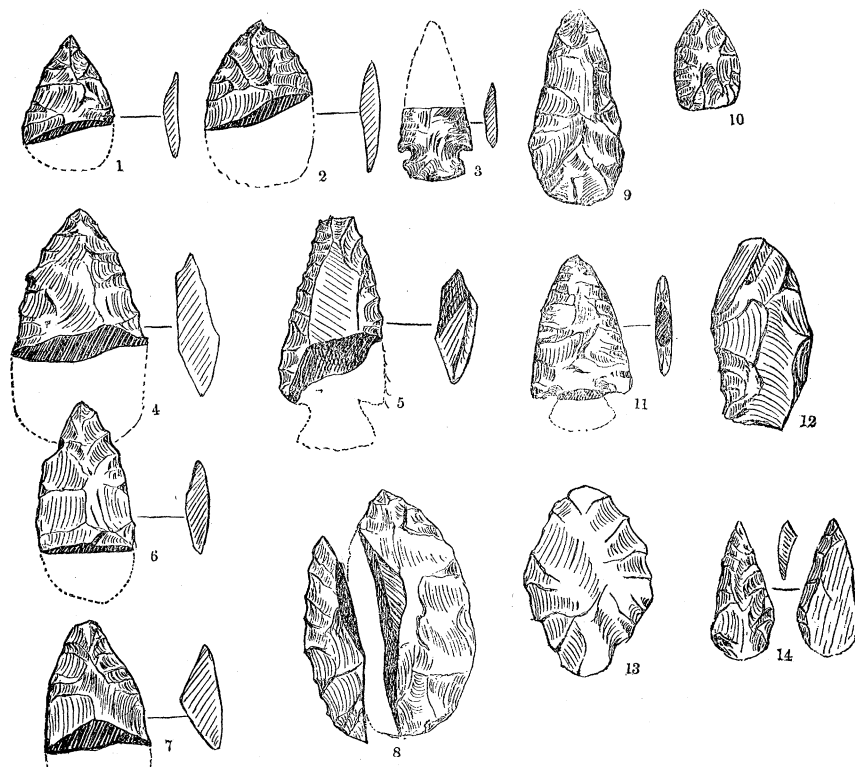
Arrow-points at Evanston, Ill.

IN the sand-ridge at Evanston, just back from the beach, and which follows the shore more or less

flint-chippings for an area of several square yards, marking spots where formerly stone implements were chipped. The very fresh appearance of the chippings upon the surface at this remote day, as if just dropped there, is accounted for by the sweeping of the wind from the exposed quarter over such localities, winnowing the particles of sand from the heavier flint. The chippings scattered in the light soil around the operator, while he fashioned the implements, remain at the original site; but, as the sand is gradually blown away, they appear at a lower level than before, and strewn over the hard, smooth surface which the wind has left.

In protected places, on the other hand, where the blowing sand accumulates in drifts, chippings, instead of being exposed, have been covered to a considerable depth, as excavations in the vicinity often show.

The mineral used was in all cases a reddish chert of various shades, found abundantly in the shape of rounded stones upon the beach. The chippings are irregular flakes, amounting in certain localities to what might readily fill a bushel basket; and search nearly always reveals some broken and unfinished arrow-points of the same mineral. The successive stages occur, from the rough chert flake to the completed implement; the most common being simply a half-arrow point, presenting a fracture across the shorter diameter: more rarely, specimens show a lon-



continuously for a number of miles south, there are exposed intervals where the frequent violence of the lake-winds does not permit the usual growth of vegetation. These places are often scattered with

itudinal fracture. The abundance of specimens indicates that occasionally, after an implement had assumed nearly the desired shape, an unskilful stroke split it; and the pieces were allowed to fall with the

waste chips. Nos. 1-8 and 11 are such supposable instances. Both parts of No. 8 were picked up. Few entire or finished implements occur, as they would not be left in these places unless lost. Nos. 9 and 10 are complete; Nos. 12-14, roughly chipped and supposable unfinished.

Proximity to the supply of chert has doubtless determined this common occurrence of chippings in the sandy stretches near the lake. There is no evidence at hand of greater antiquity than the Indian.

W. A. PHILLIPS.

Evanston, Ill., Feb. 15.

Illusive memory.

For some time past, I have been investigating a curious psychical or psycho-pathological experience which is alluded to by many writers upon psychology, and is not infrequently met with in general literature. It is that vague sentiment of familiarity we sometimes have upon entering a new experience, best expressed in the words, 'I have seen or known all this before.' It has been explained by various writers, upon two widely different theories. The first is, that this 'double perception,' 'double thinking,' 'double presentation,' as it has been variously named, arises from the dual structure of the brain, resulting in cases of imperfectly correlated action in two images or impressions not absolutely simultaneous: the latter, therefore, is a repetition of the former, and gives rise to a sentiment that it has passed through the mind at some indefinite previous time. This theory, it will be observed, is a physiological one. The other theory is, that the phenomenon is a purely psychical one; that the false or illusory memory (*Erinnerungstäuschung*, Sander) has a real basis in some actual past presentation which is identical, or closely similar, with the present one; or in some past images of the waking imagination, or dream-life, that, although these cannot be recalled into consciousness, they are sufficient to give us the conviction that the present event is the repetition of a former one — why, or how, we do not know. There are several cases upon record, where this sentiment has assumed a pathological character, and become a continual delusion, attending every experience.

Two years ago, in the hope of obtaining more information, I distributed a question upon the subject among a large number of persons, principally college-students. It may now be given in somewhat amplified form, as follows:—

Have you come suddenly upon an entirely new scene, and, while certain of its novelty, felt inwardly that you had seen it before — with a conviction that you were revisiting a dimly familiar locality? Mention, if you can, an instance or two in which this has occurred. Has any satisfactory explanation of this experience ever suggested itself to you? How frequent is the experience in your case? Was it more frequent in childhood than at present? How soon do you usually become conscious of the deception? Does it occur more frequently in connection with some kinds of experience than with others?

A quantity of material upon this subject has already been collected in this and other ways, which I hope to publish in a review article in April. In the mean while, any information bearing upon this question will be of great assistance and value to me.

HENRY F. OSBORN.

Princeton, N.Y., Feb. 23.

Ripple-marks in limestone.

The alternating limestones, shales, and sandstones of the upper coal-measures of Kansas are well ex-

posed along the ridges and water-courses near Eureka. Some of the limestone is thin-bedded, apparently due to interlaminated sheets of argillaceous material. The layers of limestone, however, seem to contain little foreign matter, certainly not more than the Trenton limestones (Buff) of Wisconsin and Minnesota. The organic remains consist largely of crinoid columns, shells of brachiopods and lamellibranchs, and a few gastropod shells and cup corals. Nearly every layer of limestone shows these remains in great abundance firmly bound together by the highly crystalline matrix.

I have been thus particular in describing the limestone, that the conditions which made the following feature possible may be understood. Some six or eight slabs of this limestone in one of our sidewalks are clearly and distinctly ripple-marked. This is the first instance of the kind that has fallen under my observation during ten years of state and private work in nearly as many states of the Union.

The occurrence of ripple-marks in calcareous mud containing the remains of deep-sea, clear-water animals, and interlaminated with argillaceous mud, is a combination not quite in accordance with the teachings of our text-books in geology.

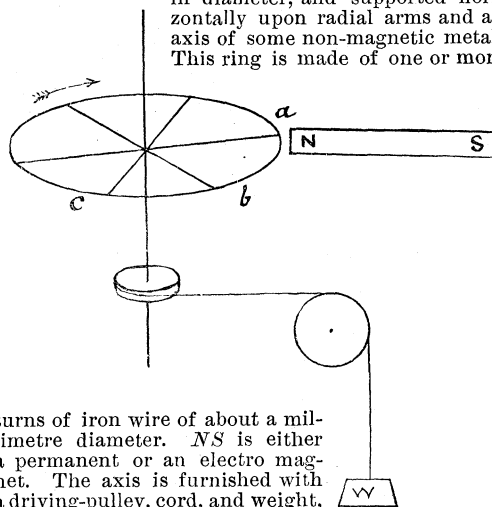
L. C. WOOSTER.

Eureka, Kan., Feb. 23.

A novel magnetic engine.

It is a well-known fact that iron, when heated to a red heat, ceases to be magnetic; so that an armature, after being heated to redness, may be removed from its magnet by the expenditure of only a small fraction of the energy which is developed by the attraction of the same armature when it has cooled.

Manifestly this fact might be employed in the construction of a motor, which, while of no practical value, is of theoretical interest, in which a permanent magnet should act as the direct motive force. This has been done in the following manner. In the figure, *abc* represents a ring thirteen centimetres in diameter, and supported horizontally upon radial arms and an axis of some non-magnetic metal. This ring is made of one or more



turns of iron wire of about a millimetre diameter. *NS* is either a permanent or an electro magnet. The axis is furnished with a driving-pulley, cord, and weight, as shown in the figure.

That part of the ring which lies between *a* and *c* is heated to bright redness by means of two or three Bunsen burners. The magnet then exerts a preponderating attraction upon the farther or cool side of the ring, and the latter revolves as indicated by the

arrow. As fast as the ring enters the space abc , it becomes red-hot and non-magnetic, and a lack of equilibrium is thus maintained which results in a continuous rotation.

The motion is necessarily quite slow on account of the considerable time required to heat the iron ring. In the actual experiment, moreover, considerable difficulty was experienced from the distortion which the ring underwent when softened by the heat, in consequence of which the speed of rotation became very irregular. With a permanent steel magnet, a speed of about one revolution in two minutes was obtained; and with a powerful electro-magnet, a weight of six grams was raised fifty centimetres in six minutes, and, in a second experiment (the ring having become quite distorted), ninety centimetres in thirty minutes.

Of course, the source of energy is the Bunsen burners; and the experiment leads at once to the fact, that the specific heat of magnetized iron is greater than that of unmagnetized.

CHAS. K. MCGEE.

University of Michigan,
Ann Arbor, Feb. 19.

Congenital deafness in animals.

The communication of Professor Bell in No. 54 of *Science*, in reference to Mr. Lawson Tait's statement that no other animals than cats are affected with congenital deafness, calls to my mind the fact, that in my early boyhood I had a dog which was thus afflicted. I got him when a puppy; and, so far as we could determine, he was never able to distinguish any sounds. He was of the breed usually known as 'fist,' and, so far as my memory serves me, was of a yellow color: certainly he was not pure white. What renders this instance the more interesting, is the further fact, that a playmate of mine also had a deaf dog. I think he was of the same family, but not, I believe, of the same litter. That congenital deafness should be rare among wild animals, I can readily understand, since, in the struggle for existence, their defect would lead to an early extinction; but under domestication, where their conditions approach more nearly to those of man, I can see no reason why a defect of physical organization should not be transmitted by inheritance, as I believe it to have been in the cases above cited. It is a fact well known to aurists, that in some families there is a tendency to become hard of hearing, or even deaf, at about the same age; owing, doubtless, to certain evolutions which take place in their physical structure at that time.

SWAN M. BURNETT, M.D.

Washington, Feb. 22.

A singular optical phenomenon.

The windows of our office are provided with fly-screens having the ordinary mesh of something less than an eighth of an inch. Thirty feet across the way is a building whose windows are protected by a coarse screen having a mesh a little less than half an inch in size. Standing about ten feet back from and looking through the fly-screen at the coarse screen, an inverted, magnified image of the latter is seen in mid-air, between the observer and the fly-screen; the inversion, of course, being only detected by the apparent movement made by the image on changing the position of the eyes. The explanation of the phenomenon is not difficult. The lines of the coarse screen throw nominally a single ray of light, which is inverted through the particular mesh of the fly-screen directly in line with it and the observer. Any other substance, such as a paper wad introduced in the coarse screen, will not appear in the image. It may

not be uninteresting to mention in this connection the fact, that while a short-sighted person, to whom I endeavored to show the same phenomenon in my home, using as an object the slats of a blind in a house a hundred and fifty feet away, was unable to see the actual slats, owing to their remoteness, their image was distinctly visible to her.

F. J. S.

Deflective effect of the earth's rotation.

In a letter of mine, published in *Science*, ii. No. 26, I suggested that the deflecting force produced by the rotation of the earth on bodies moving on its surface is not wholly represented by the rotation of a tangent plane, but depends, in part, on the centrifugal force resulting from the body's relative motion in longitude, and is therefore greatest when the motion is perpendicular to the meridian.

That my suggestion is *not* true, and that the force is the *same* for all directions of the motion, may be demonstrated very simply, as follows:—

From the proposition announced in section 25 of Peirce's 'Analytical mechanics,' it follows that any tangent plane whose latitude is λ rotates about an axis normal to that plane with an angular velocity equal to $\omega \operatorname{cosec} \lambda$, ω denoting the angular velocity of the earth about its polar axis.

Therefore if P represent the point where the normal axis pierces the surface of the sphere, and if a body be caused to move in any direction over the point P with a velocity v , it will, by the rotation of the tangent plane, be constrained to describe in space the spiral of Archimedes, whose equation is $u = a\theta$; and when $\theta = 2\pi$, $u = v$ multiplied by the time of one rotation of the tangent plane. Hence, if one hour be the unit of time, $u = 24v \operatorname{cosec} \lambda$; and $\frac{1}{2}a$, = the radius of curvature at the origin of the spiral, $= 6v \div \pi \sin \lambda$.

Now, the deflecting force at P is equal to the centrifugal force due the velocity v at the origin of the spiral, which is represented by $v^2 \div \frac{1}{2}a$:

$$\therefore f = \frac{1}{2} v \pi \sin \lambda.$$

But the centrifugal force, $V^2 \div R$, due the rotation of the earth at the equator, is known to be $\frac{2}{3} \frac{1}{2} \pi mg$; mg denoting the weight of the body, and $V = \frac{1}{2} \pi R$:

$$\therefore f : \frac{2}{3} \frac{1}{2} \pi mg :: \frac{1}{2} v \pi \sin \lambda : V^2 \div R;$$

whence, substituting for V^2 , we get,

$$f = \frac{\frac{2}{3} \frac{1}{2} \pi mg \cdot 24 v \sin \lambda}{\pi R}.$$

The centrifugal force resulting from the body's relative motion in longitude affects only the origin of the spiral, and not at all its elements, and hence has no influence on the value of f : consequently f is the total deflecting force, and is independent of the direction of the motion.

J. E. HENDRICKS.

Des Moines, Io., Feb. 14.

A carboniferous genus of sharks still living.

I observe that in a late number of *Science*, Mr. Garman describes a new genus of sharks from the Japanese seas, under the name of *Chlamydoselachus*. The figure of the teeth which he gives shows the animal characterized by Mr. Garman to be a species of the genus *Didymodus* (Cope, Proceedings Philadelphia Academy, 1883, p. 108, equal to *Diplodus* Agass. Poiss. fossiles, pre-occupied in recent fishes), which has hitherto been supposed to be confined to the carboniferous and Permian periods. The species possess two, three, or four denticles. Material in my possession enables me to fix the position of this genus, which I will endeavor to explain in the next (April) number of the *American naturalist*. *Didymodus*

becomes by this discovery the oldest living type of vertebrata.

E. D. COPE.

Philadelphia, Feb. 28.

Artificial production of rain.

I give below an instance which came under my own observation, of the artificial production of rain, which may be interesting, read in connection with the article in *Science*, No. 55.

Many years ago, during my residence in Virginia, the whole of the eastern portion of that state had been suffering one summer from a long-continued drought. For several months not enough rain had fallen at any one time to moisten the ground to the depth of half an inch. The atmosphere was gray, and full of dust. The sun, even at noonday, was 'shorn of his beams,' and could be looked at directly without pain to the eyes. The temperature was not unusually high; but the weather was very oppressive, being what is called in the country, 'muggy.' One of my neighbors had several months before cut down, and left lying where it fell, a young forest of scrub pines from a field of about forty acres in extent. These pines had, of course, become, during the long drought, completely dry. One August morning, the meteorological conditions remaining exactly as they had been for months before, my neighbor caused fire to be set to this clearing at several points on the circumference at the same time. The fire ran over the whole tract with wonderful rapidity. An immense column of inky smoke rose perpendicularly (there was no wind) to a great height. Upon reaching a stratum of air of its own density, the black column spread out horizontally into the form of a gigantic mushroom, rapidly changed color from jet black to gray, and soon thunder was heard in the top of the ascending and spreading column. The fuel was gradually consumed, and the smoke ceased; but the cloud continued to spread, and rain began to fall in a little more than an hour from the time the clearing was fired.

The thunder gradually ceased; but rain continued to fall until sunset, when the sky cleared. For the remainder of the season, showers and rain-storms occurred with ordinary frequency, as if the conditions favorable to the continuance of the drought had been permanently broken up. Observations of temperature, the dew-point, and of the barometer, would have been valuable; but I had unfortunately no instruments at hand for obtaining them.

While the artificial production of rain can have no economical importance, — depending, as it necessarily must, upon many meteorological conditions, which, to be effectual, must be synchronous, — yet an example of a rainfall of several hours' duration, which was undoubtedly produced by an ascending column of heated air artificially supplied, seems worthy of record.

L.

Annual growth of the 'Tree of heaven.'

I have in the cabinet of Cumberland university two remarkable shoots of *Ailanthus glandulosus*, Desf., a description of which may be of interest to botanists. They grew in a lot near one of the university buildings during the summer of 1883. They sprang from small stumps, and are entirely the growth of one season. They give the following measurements:—

No. 1. — Length, 10 feet 6 inches; circumference at base, 5.1 inches; circumference at middle, 4.13 inches.

No. 2. — Length, 11 feet 1.5 inches; circumference at base, 4.1 inches; circumference at middle, 3 inches.

J. I. D. HINDS.

Lebanon, Tenn.

GOUVERNEUR KEMBLE WARREN.

IN the death of Gen. Gouverneur Kemble Warren of the Corps of engineers, U.S. Army, the country has lost not only one of the ablest military leaders developed by the civil war, but also a scientific man of high attainments, whose life was devoted to profound investigations connected with several of the most important works of internal improvement undertaken by the general government.

He was born on Jan. 8, 1830, at the little village of Cold Spring, upon the Hudson, where his surroundings were all calculated to excite a love for the military service in the mind of an active and intelligent boy. West Point lay in plain sight from his home. The old field-works of the revolution, grass grown and crumbling, were associated with his earliest recollections; and the charm thrown by Washington Irving over this classic ground of American history entered into and stimulated his youthful imagination to ideas above the prosaic monotony of every-day life in the nineteenth century. The Mexican war added fuel to the flame; and at the early age of sixteen he sought and obtained an appointment as cadet at the Military academy. He was graduated in 1850 with very high class rank, and was at once assigned to the corps of topographical engineers.

The great problem then beginning to attract attention was the Pacific railroad. The recent discovery of gold in California, and the consequent rush of immigration to the west, demanded increased facilities for transit across the continent; but a broad belt of wilderness, intersected by lofty ranges of mountains, and almost unknown, barred the way. It was in this field that the young officer did his first important scientific work.

Congress made large appropriations for exploring several routes between the Mississippi River and the Pacific Ocean; and the work, under the direction of Gen. (then Capt.) Humphreys, was performed by officers of U.S. engineers. As usual in such cases, the results were expected at once; and Lieut. Warren, who had already shown his ability on the surveys of the Mississippi delta, was detailed as principal assistant in the general office at Washington.

His duties were twofold. He assisted Capt. Humphreys, then laboring under great pressure, in digesting the preliminary reports, in investigating the various problems connected with railroad transportation, in making the comparative estimates of cost, and in preparing

the general report. His labors were so valuable in this connection that his chief placed their names jointly on the titlepage of what was a very able document. In addition to this work, Lieut. Warren was specially charged with compiling a general map of the entire region covered by the surveys. This labor demanded powers of analysis of a high order.

It was needful to thoroughly study the work of all explorers to date, and, by assigning proper weight to each, to combine the material, often conflicting and discordant, into one consistent and harmonious whole. This task Warren accomplished with surprising success, as has been proved by accurate surveys subsequently extended over much of the ground. His memoir and map, which appeared in the eleventh volume of the final quarto edition of the Pacific railroad reports, will remain a standard authority to geographers studying the early history of exploration in that region.

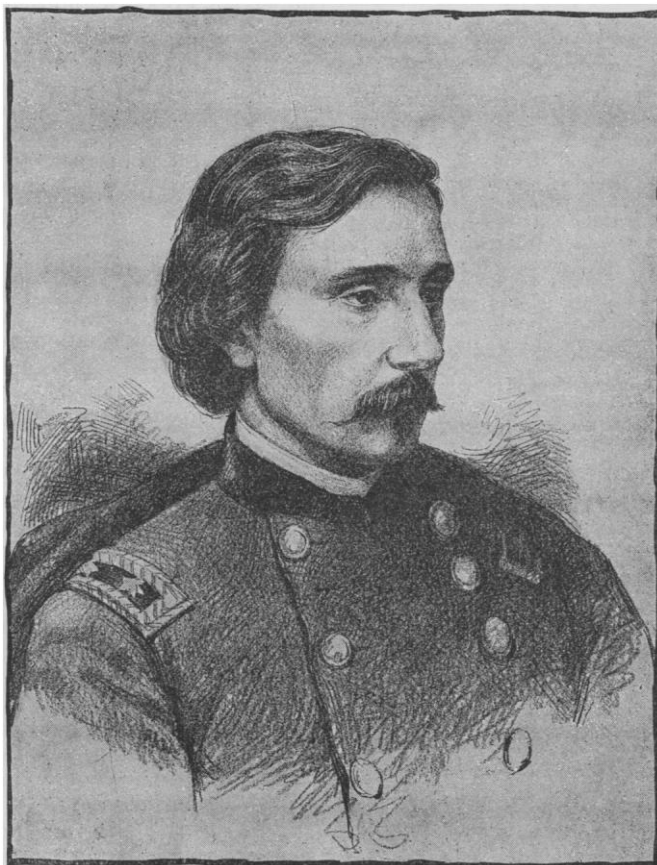
As might naturally be supposed, an ambitious young officer would not be satisfied with office-work alone, when laurels were to be won in a field involving no little hardship and risk from the semi-hostile Indian tribes which then roamed unsubdued over the vast plains west of the Mississippi. He sought and obtained di-

rection of three separate explorations in Dakota and Nebraska, in the years 1855, 1856, and 1857; and, while thus collecting much valuable information needful for opening the country to civilization, he gratified his own strong passion for geological research, and laid the foundation for subsequent generalizations which have attracted the attention of men eminent in that special branch.

Space forbids any notice of Gen. Warren's war record here. Suffice it to say, that, entering the volunteer service among the very first of the officers of the regular army (on May 14, 1861), in two years and three months he fought his way from the grade of lieutenant-colonel to that of major-general commanding an army corps. He was present at all the great battles of the army of the Potomac, and was justly regarded as one of the best generals and most gallant officers made known by the war. He was twice wounded in battle, and had several horses shot under him.

Immediately after the fighting ceased, he returned to duty

as major in the Corps of engineers, and soon began to perform an amount of labor in the civil branches of his profession which would have broken down a man of less nervous energy. To simply enumerate the various works with which he was charged between the



G. K. Warren
Major General

end of the war and the date of his death on Aug. 8, 1882, would extend this notice beyond reasonable limits. They can only be classified and briefly explained.

As an expert in railroad-engineering, Gen. Warren served on three different commissions to inspect and report upon the construction of the Union Pacific and Central Pacific roads and their branches, and to indicate their proper point of junction.

His military experience caused him to be selected to make the detailed surveys of the battle-field of Gettysburg, and of the vicinity of Groveton, Va., in connection with the Fitz-John Porter investigation.

As an hydraulic engineer, his labors covered several of the most important works in the United States, and gave him great eminence. He was a member of the board to report upon the Fort St. Philip canal project, and was president of the commission of engineers appointed by special act of Congress to report upon the best method of protecting the alluvial region of the Mississippi against overflow. He conducted a very elaborate survey and investigation with a view to improve the navigation of the Fox and Wisconsin rivers; and his report, a model of excellence, has borne the test of practical trial subsequently applied. His surveys and reports upon the improvement of the upper Mississippi and of the Minnesota River are also of standard authority. His name is identified with the improvement of the Connecticut River, and with various harbor improvements upon the coast of Massachusetts, Rhode Island, and Connecticut; and his labors in hydraulic engineering at other special localities are too numerous to mention.

Gen. Warren also contributed much to the subject of bridge-construction. The Rock Island bridge was built essentially upon his plans and specifications; and his services upon boards ordered to report upon bridges projected or constructed at many important localities involved great labor and research. His reputation in this branch of engineering, however, will chiefly rest upon his monograph upon bridging the Mississippi River between St. Paul and St. Louis. This work was unique in character. The investigation was ordered by Congress to collect data for harmonizing the conflicting interests of navigation and of railroad transportation; and the subject was treated exhaustively, not only from an engineering, but also from a legal point of view. The investigations extended over a period of more than eleven years; and the report is a standard authority to be consulted in any

future bridge-projects over navigable western waters.

Gen. Warren's natural fondness for geological research has already been mentioned. His extensive explorations in Dakota and Nebraska; his numerous surveys for determining the topographical features of the valleys of many rivers in Minnesota, Wisconsin, Iowa, and Illinois; his investigations in respect to foundations for bridges in this district; and his thorough familiarity with all the geological and topographical reports upon this vast region, and north of it in British America, — enabled him to frame an hypothesis as to geological changes that have occurred, and are now occurring there, which is both novel and brilliant. He first announced it in a paper read at the Chicago meeting of the American association for the advancement of science in 1868, and subsequently elaborated it in his report upon the Minnesota River and in that upon bridging the Mississippi.

Very briefly outlined, it is the following. Lake Winnipeg formerly covered much more space than at present, and extended southward to the head of the Minnesota valley, through which it drained, thus forming the source of the Mississippi. The present outlet to Hudson Bay (Nelson River) did not then exist. The change of drainage has been effected by an elevation of the southern, and a subsidence of the northern, portions of the continent, which have been in slow progress for a vast period of time. When this change began, it caused a decreasing river-slope in the northern portions, and a diminishing power to erode. The resistance due to the granite ledges extending over a hundred miles below Big Stone Lake, in the bed of the upper Minnesota, checked further erosion there, and formed a growing lake above it, which finally found a new outlet to Hudson Bay through the loose drift near Nelson River. This was rapidly eroded, thus reducing the old lake-surface to the present level of Lake Winnipeg, which is about three hundred and sixty feet below the present sources of Minnesota River. Like changes, due to the same cause, by which Lake Michigan has been cut off from the Illinois River, and Lake Winnebago from the Wisconsin River, may be traced.

Gen. Warren discussed this hypothesis in detail, and showed, by so many facts as almost to amount to a demonstration, that, since the glacial epoch, two secular oscillations of this character have occurred in this region. The reasoning is masterly, and illustrates both his breadth of conception, and his care to conclude no farther than the facts warrant.

Although modest and retiring to a fault, the

earnest scientific work which he had done and was doing was appreciated; and in 1876 he was elected a member of the National academy of sciences. He had long been a member of other learned societies, and was widely known and respected among scientific men.

In person, Gen. Warren was of medium height, and slightly built. His mind was intensely active. Nervous in temperament, and sometimes irritated at trifling annoyances, he became instantly cool and self-poised in times of real danger or difficulty. In close logical reasoning he had few superiors. His mental habits were those of an investigator, — never satisfied until he had studied the matter in hand in all its bearings; but in action he was impetuous, indomitable, and gallant in the extreme. His reading was extensive, both in science and literature, — due largely to his habit of seeking mental rest by working in a new direction. His sense of humor was keen, and his conversation was often brilliant as well as instructive. In disposition he was kindly and sympathetic, and he never failed to give others full credit for whatever good work they had done. He loved justice for its own sake; and the natural tendency of his mind was always to assist the weak, and to strive to redress wrongs wherever found. These traits of character endeared him to his friends; and his memory is cherished with mingled feelings of respect and regard, not easy to express.

HENRY L. ABBOT.

APPENDAGES OF THE TRILOBITE.

THROUGH the kindness of Mr. D. A. McCord, the owner of the trilobite described by Professor John Mickleborough (*Cinc. journ. nat. hist.*, vi. 200, 1883), I have had an opportunity to study the original specimen, and prepare a few notes upon it.

When received, the specimens — i.e., matrix and relief — were not free from the grease and dirt acquired in the process of taking casts and frequent handling. On giving them a thorough washing in a solution of potash, this was removed, and also a thin film of decomposed rock on the parts beneath the pygidium. Turning to the laboratory window, to have the sunlight strike across the specimens while still wet, much to my surprise, the appendages shown beneath the pygidium were seen to be of the same character as those beneath the thorax, a number showing in some instances two and three joints attached to the basal joint. On a more careful examination, numerous fine slender filaments were discovered, both

beneath the thorax and pygidium, and also near the posterior end of the latter slender jointed appendages not half a millimetre in diameter. Having cut up over two thousand trilobites without discovering any 'branchigerous' appendages beneath the pygidium, other than the spiral and ribbon-like branchial filaments, — such as were attached to the basal joints of the thoracic legs, — naturalists can appreciate the feeling of satisfaction that the discovery of these jointed appendages, so much like those found in cutting sections of *Ceraurus* and *Calymene*, gave the writer.

The breaking-apart of the surfaces carrying the legs and their matrix left the legs beneath the thorax in relief; but beneath the pygidium the joints were broken longitudinally, and only a plain outline section is seen. It is probably owing to this that these were overlooked by Professor Mickleborough, and the space beneath the pygidium considered as showing leaf-like or foliaceous appendages. For the purpose of clearly indicating the actual relations of the portion of the Ohio trilobite showing the legs, to the entire dorsal shell of the same species, a figure of the under side of the shell was outlined; and then the Ohio specimen was carefully drawn as if resting in it, as shown in fig. 1. In the specimens, some of the appendages are shown more distinctly in the matrix, and others in the relief. In the drawing, the two are combined so as to give, without restoration, what is actually present in the specimens. Twenty-six pairs of appendages are clearly discernible. Of these, nine are situated beneath the thorax, one beneath the posterior margin of the head, and sixteen beneath the pygidium. From the character of the appendages beneath the thorax, none of them appear to have belonged to the manducatory apparatus; the ninth posterior pair having been crowded forward from beneath the pygidium. The anterior pair beneath the head is very imperfect; but sufficient remains to show that these appendages were intimately associated with the cavity of the head, which is now filled with calcite, and they probably represent a portion of the posterior pair of manducatory appendages. In *Calymene senaria* and *Ceraurus pleurexanthemus*, the posterior pair of manducatory appendages are always provided with a large basal joint, and undoubtedly the same was the case with other genera of trilobites. The appendages beneath the pygidium are, however, of the greatest interest. I have seen many trilobites, when cutting sections, that had the cephalic and thoracic legs clearly and distinctly defined; but, owing to the small size of the pygidium of *Calymene*

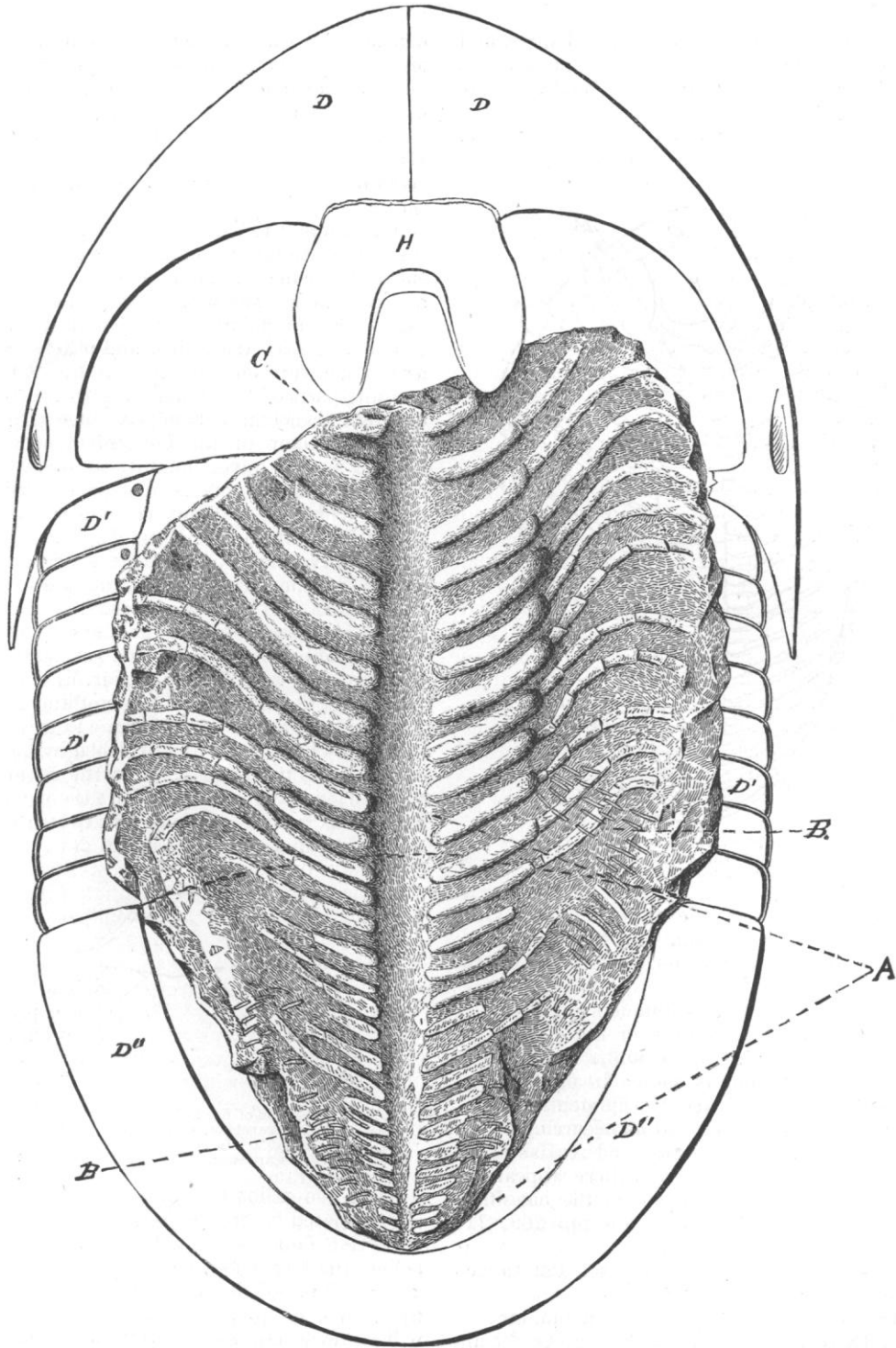


FIG. 1. — Outline of the under side of the dorsal shell of *Asaphus megistos*, with the fragment of the Ohio trilobite, showing the legs, resting in it. *H*, hypostoma; *D*, doublure or infolded margin of the dorsal shell; *D'*, same of the thoracic segments; *D''*, same of pygidium; *C*, portion of posterior pair of cephalic appendages; *A*, abdominal appendages; *B*, branchial filaments. The latter are enlarged to show their position.

and *Ceraurus*, there was always some doubt about the number of appendages that were to be assigned to the pygidium. That they were jointed and not foliaceous appendages, I had no doubt, and so stated it in the text,¹ and also in the restoration, of which fig. 2 is a copy.

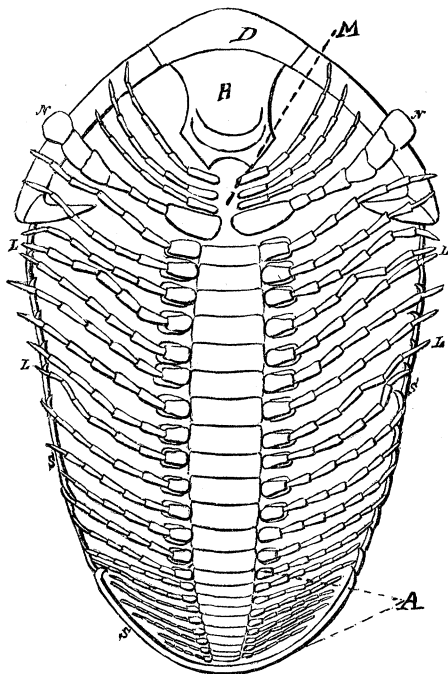


FIG. 2.—Under side of *Calymene senaria* as figured in *Bull. mus. comp. zool.*, vol. viii. pl. vi., 1881. *H*, hypostoma; *M*, mouth; *A*, abdominal appendages.

The leg beneath the thorax of the Ohio trilobite shows seven joints in two instances: the character of the terminal joint is unknown.

The discovery of this unique specimen fully establishes the correctness of the restoration made by the writer of the ambulatory appendages of *Calymene*, as shown in fig. 2. The few traces of the branchial filaments do not differ from those described as occurring in the genera *Calymene*, *Ceraurus*, and *Acidaspis*.

From the evidence given, there appears to be no necessity for a change in the classification of the trilobites given on pp. 209, 210 (*ibid.*):—

Class, Poecilopoda; sub-class, Palaeadae; order, Trilobita.

Trilobita: ex., *Asaphus*, *Calymene*, etc.

1. Eyes sessile, compound. 2. Ocelli unknown. 3. Cephalic limbs serving as mouth-

organs. 4. Thoracic segments bearing jointed legs and attached branchiae. 5. All segments bearing appendages. 6. Thoracic segments unanchylosed. 7. Abdominal segments anchylosed, and bearing jointed appendages. 8. Hypostoma large (metastoma unknown). To section 7 we now add ' (similar to those of the thorax). '

The attempt to locate the branchial apparatus of the trilobite beneath the pygidium is not surprising when a comparison with *Limulus* and *Serolis* is made with those trilobites having a large pygidium; but in such genera as *Conocephalites*, *Arionellus*, and others having a pygidium very small, as compared with the remaining parts of the animal, the necessity for a different branchial system is at once apparent.

The director of the Geological survey of Canada having given permission to have the original specimen of *Asaphus platycephalus*, described by Mr. Billings as showing ambulatory legs, sent to me, Prof. J. F. Whiteaves kindly forwarded it; and the specimen was placed by the side of the Ohio trilobite for comparison. A glance showed that Mr. Billings's interpretation was the correct one, and that, as far as the thoracic legs are considered, the Canadian trilobite has a pair for each segment. Of the abdominal legs nothing is seen. The only addition to our knowledge of the structure of the trilobite, furnished by the Ohio specimen, is the verification of the hypothesis that the legs were jointed beneath the pygidium, as shown in the sections of *Ceraurus* and *Calymene*, and expressed in fig. 2.

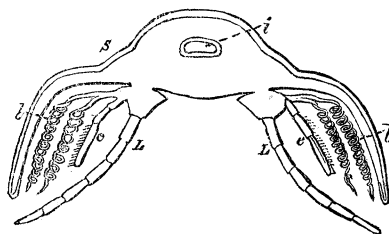


FIG. 3.—Cross-section of fig. 2. *s*, dorsal shell; *i*, alimentary canal; *B*, spiral branchiae; *e*, epipodite; *L*, leg. Taken from same plate as fig. 2. In some instances the branchial filaments or ribbons are straight and not spirally coiled.

That the trilobites and crustaceans were differentiated before the existence of the oldest Cambrian fauna we now know, is my present belief, the two classes coming down on two distinct lines of descent. In a paper now in the course of preparation, the entire subject will be reviewed, and illustrations given of the different orders of the class Poecilopoda.

CHARLES D. WALCOTT.

¹ *Bull. mus. comp. zool.*, vol. viii. p. 204, 1861.

*THE NEW BOGOSLOFF VOLCANO IN
BERING SEA.*¹

On Tebenkoff's chart of Unalashka Island, and the adjacent passes from Unimak to Umnak Islands, there is placed in latitude $53^{\circ} 51'$ north, and longitude $167^{\circ} 40'$ west, an islet about half a mile in extent, with rocky, bold shores, and somewhat flattened top. It has deep water close around it, and no outlying dangers except to the north-north-west, where a small 'pinnacle rock,' or 'sail rock,' lies a few hundred yards distant.

The rocky islet is known as 'Bogosloff.' In his account of his voyages,² Cook says, that on the 29th of October, 1778, he discovered 'an elevated rock which appeared like a tower;' and he judged of its steepness below the surface of the sea by the circumstance that the sea (which was running very high) broke nowhere but against its sides.

I have plotted Cook's position with regard to this discovery, made when he was only four leagues to the south-westward of the islet, and was steering a north-easterly course. From his language, I cannot decide whether he passed on its northern or southern side.

His footnote says, that, though this mass had no place on the Russian map produced by Ismyloff,³ it was indicated on the chart of Krenitzen and Levasheff. Cook placed it about seventeen miles north of the northern shore of the island of Umnak. His longitudes are all too great by more than a degree, but the relation of the islet to the adjacent islands fixes its position.

This reference to Cook's position is somewhat important; because, on an admiralty chart of Bering Sea and the Arctic Ocean (1859), and on a U. S. chart corrected to 1868 (Exploring expedition under Commander John Rodgers, U. S. N.), this islet is called the 'Bogosloff volcano;' and the statement is made that it rose in 1796,—eighteen years after Cook had described it.

Tebenkoff, in 1848 (perhaps following Saricheff in 1829), calls it 'St. John the theologian Island,' or, rather, 'rock,' and gives it a circumference of two miles. According to Saricheff, its height is about four hundred feet; but the navigators of the Russian-American company made it six hundred and twenty feet. Tebenkoff says Pillar Rock lies four hundred yards north-north-west of Bogosloff Island.

On the admiralty chart and on some of the Russian charts (including those of Saricheff), and even on the chart published by the U. S. hydrographic office in 1855, a dangerous reef is laid down between Bogosloff and the northern end of Umnak. The U. S. chart, corrected to 1868, repeats this danger; and it is even laid down on the U. S. circumpolar chart of 1882. Tebenkoff says this 'dangerous reef' does not exist: Veniaminoff says the natives deny the existence of the reef, but report great current or tide rips, which are dangerous to their bidarkas. In 1867 I had the same information from the Russian priest, Shayesnikoff, —a man of more than ordinary knowledge and capacity, and well acquainted with the islands, which he visited regularly in the course of his ministrations: also the Alaska commercial company's navigators have passed between Umnak and Bogosloff islands. Neither the Bogosloff, the reef, nor the northern part of Umnak, is on Kotzebue's chart of 1817.

The height of this volcanic island varies according to the authority from which the estimate has been obtained, as already indicated. Tebenkoff gives estimates, from two authorities, of four hundred and six hundred feet. On my chart I have a note stating the height to be eight hundred and forty-four feet, but I had forgotten to state the authority for that estimate. I suppose that I obtained it from one of the Russian navigators, in 1867. The captains employed by the Alaska commercial company, however, estimate the height at from two hundred and fifty to three hundred and fifty feet.

Of this islet I collate the following facts, without examining many authorities:—

1778.—Cook saw it, Oct. 29, in clear weather. He says it is on the charts of Krenitzen and Levasheff.

1796.—Veniaminoff, calling it 'St. John the theologian,' states that it arose out of the sea on May 7 of this year; and that, at the time, there were, according to Krusenstern and Langsdorff, earthquakes and eruptions.

1800.—It was smoking (Kotzebue).

1802.—It was smoking (Langsdorff). (At that time the volcano Makushin was throwing out volumes of smoke and fire.)

1804.—It was smoking from one crater (Kotzebue).

1806.—The burning lava was flowing down the north side (Langsdorff).

1814.—The crater threw out stones (Baranoff).

1815.—It was diminishing in height (Baranoff).

¹ Communicated by Prof. J. E. Hilgard, superintendent U. S. coast and geodetic survey. See also *Science*, No. 51.

² Vol. ii. p. 528. Third admiralty edition.

³ Ismyloff was the principal trader at Unalashka, and had produced charts of several of the islands, etc., with which he was personally familiar, and showed them to Cook.

1816-17. — It had no activity (Eschscholtz).

1820. — It was smoking (Dr. Stein).

1823. — It was not smoking (Veniaminoff).

1832. — There was no smoke (Tebenkoff, Lütke).

Although frequently seen in later years by the navigators of the Russian-American and Alaska commercial companies, and by the whalers, no one has noticed it as exhibiting any signs of activity.

In an other part of Veniaminoff's work, in giving more particulars of earthquakes and volcanoes, he writes, —

"The new island, Bogosloff, in latitude $53^{\circ} 58'$ north,¹ and longitude $168^{\circ} 5'$ west, rose from the sea in the early part of May, 1796. Before the island appeared above the sea, there had been witnessed, for a long time in that spot, a column of smoke. On the 8th of May, after a strong subterranean noise, with the wind fresh from the north-west, the new small, black islet became visible through the fog; and from the summit great flames shot forth. At the same time there was a great earthquake in the mountains on the north-west part of Umnak Island, accompanied by a great noise like the cannonading of heavy guns; and the next day the flames and the earthquake continued. The flames and smoke were seen for a long time. Many masses of pumice-stone were ejected on the first appearance of the island."

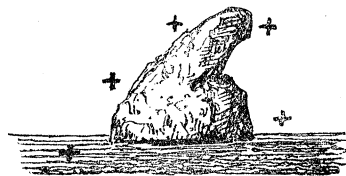
At that time it was, perhaps, only one-quarter the size of its present dimensions; and it increased in size, growing higher, and breaking down at the same time on all sides. Finally, about 1823, it seemed to become unchangeable. Until it ceased to increase in size, it was hot, as well as the sea-water around it; while smoke and steam arose from it continuously.

It is noticeable, also, in this connection, that Krenitzen and Levasheff, who made the voyage of discovery in 1768 and 1769 to endeavor to discover the track of Bering's voyage, have marked Bogosloff on their chart as situated forty miles west by south of Makushin volcano, and surrounded by sunken rocks. Their mark is a view (see sketch), and clearly indicates the peculiar shape of the islet at that time. Their course led them ten miles to the northward of it. So much for the older authorities.

Along the whole chain of the Aleutian Islands, from abreast of the Kamtchatka peninsula to the head of the peninsula of Alaska, there is a line of the greatest volcanic activity exhibited by about fifty volcanoes, of which many are living, and of which some are at times in a state of violent eruption. Some of them have an extreme elevation of about twelve thousand feet on the Alaska peninsula; while the Aleutian volcanoes range from three thousand to nine thousand feet.

¹ This latitude agrees with Cook's.

Of these living volcanoes, one is that of Makushin, on the north-western part of the large island of Unalashka, and directly overlooking Captain's Harbor, on the north side of that island; and another is the islet of Bogosloff, now under discussion, situated twenty-five miles to the westward of the north-western point of Unalashka. This islet has acquired unusual importance, because there has arisen alongside of it, from the depths of the ocean, a volcanic island over one thousand feet high. This fact also suggests inquiries into the condition of the island seen by Cook as 'an elevated rock which appeared like a tower,' and its condition in May, 1796, when it seems to have exhibited unusual signs of activity. Also it appeared, as before mentioned, to have increased in size, and continued so to do as late as 1823. It is possible that Cook saw the rock when in a state of inaction, as he made it out at a distance of four leagues, when working to the eastward under the northern shore of Unalashka; and the weather must have been clear. I conjecture that he sailed between it and Unalashka to save getting too far to leeward; and he must have had it in sight for several hours.



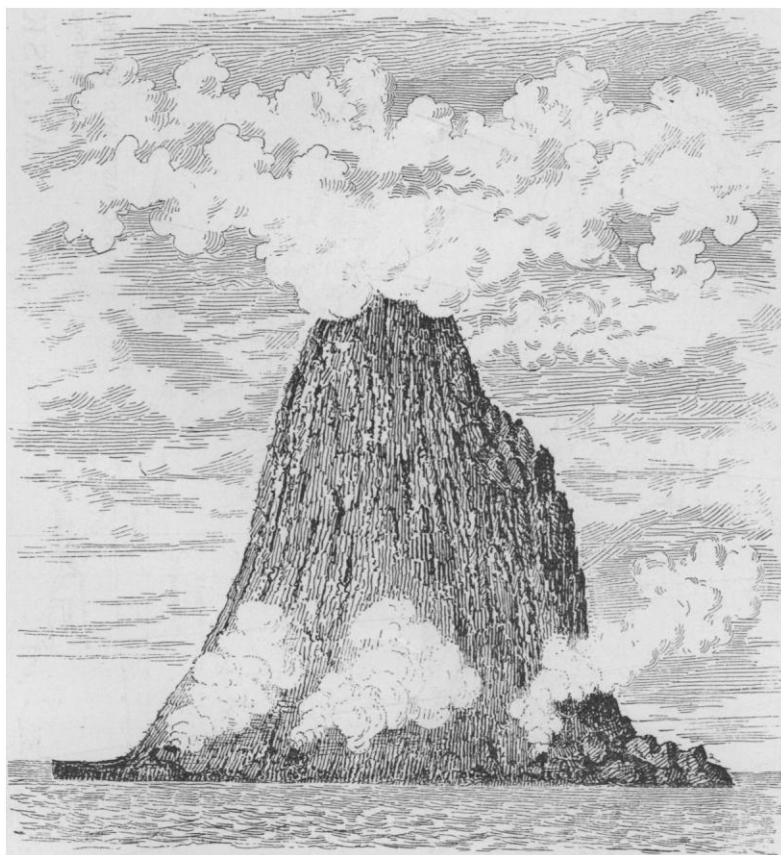
BOGOSLOFF ISLAND, DISTANT TEN MILES, AS SEEN BY KRENITZEN AND LEVASHEFF, 1768-69.

As late as September and October, 1883 (to come down to our own times), the island was seen by two captains in the service of the Alaska commercial company, — Hague and Anderson, — both of whom called upon me, described the character of this new formation, and enabled me to make a rough sketch of the islet as it appeared to them (see view). They both passed close to it, approaching from opposite sides, and thus were enabled to judge of its size, height, and general appearance. Capt. Anderson, in the schooner Matthew Turner, saw the island at daybreak (five A.M.) on the 27th of September, 1883, and passed it at half-past eight A.M. within three cables' lengths; heaving the lead as fast as practicable, with twenty fathoms of line, and finding no bottom, although the water was discolored and of a red color. The vessel first approached it on the eastern side, stood up to the north-westward, tacked ship, and passed to the west-

ward. The islet was surrounded by white smoke, like steam. The same evening, after nightfall, being then about twenty-five miles to windward of it, they saw the fire on the island.

On the 27th of October, 1883, just one month after Anderson's visit, Capt. Hague, of the *Dora*, saw the island at seven A.M., approaching it from the south-westward (just as Cook had done one hundred and five years before). He first passed through a streak of red water into a green streak beyond it (the

Both captains agree in saying that the island is larger than the old one, and is about half a mile north-north-west of it; that it rises very steeply, with a rough, ogee curve; and that the outline on the eastern side is broken on the shoulder and at the base by masses of rocks (see view, below). On the western side there is a level space just above water, and thirty or forty feet in extent, where a landing could be effected. The top was hidden by clouds; but white smoke or steam could be seen issuing



THE NEW VOLCANIC ISLAND OF BOGOSLOFF, AS SEEN SEPTEMBER-OCTOBER, 1883.

water under both conditions having the appearance of being very deep), but, fearing shoals, tacked ship to avoid a nearer approach. He came no nearer than about one mile, and had the island in sight about three hours. At that time there was black smoke issuing from it, as if tar were burning. The weather was cloudy, and no observations could be had for position; but its proximity to the old Bogosloff fixes it with equal precision.

from near the cloud-line, which was estimated to be from eight hundred to twelve hundred feet above the sea. The sides are very steep; and, apparently, it has arisen from the depths without developing outlying dangers, because, with a heavy swell running, no breakers were seen. Around the base are great steam-jets, somewhat like those near the summit. At night it looks as if the whole islet were in active eruption, and covered with fire (this

may arise from the ignition of gases escaping from innumerable apertures in the flanks of the islet).

Tebenkoff, in his description, tabulates this islet as in latitude $53^{\circ} 52'$ north, and longitude $167^{\circ} 39'$ west.

I have no doubt that during the present year (1884) we shall obtain its exact geographical position, its physical conditions, and reliable measures of its size and height.

On the 20th of October, 1883, — seven days before Hagne saw the island, — a shower of ashes took place, small quantities of which were collected at Iliuliuk, and a portion presented to the California academy of sciences. There seems some doubt, however, as to the point whence the ashes came; as the account from Iliuliuk places the date of their fall at Oct. 16, *wind being fresh from west-south-west*, with rain and sleet. It may be that this pumice-dust came from the eruption of Mount St. Augustin (see map of Alaska) on Oct. 6, under the influence of an upper current of air from the north-eastward; that mountain lying over seven hundred miles distant in that direction from Unalashka.

It is noticeable, that during the eruption from Bogosloff, or at least about that time, the two volcanoes on Akontan Island (about as far to the east-north-east of Makushin volcano as Bogosloff is to the west by north) ceased to smoke, and showed no signs of activity. These two volcanoes, only three miles apart, are 3,332 and 3,888 feet high respectively. Nothing was heard from Makushin: probably its summit was in the clouds, and might have been active.

As regards the distance to which the ashes from such eruptions are sometimes carried, it may be mentioned, that at the time of the eruption of volcano Iliamna, in March, 1867, the pumice-ashes fell on St. Paul, Kadiak Island, one hundred and sixty-five miles distant.

From the natives of Iliuliuk it was quite recently learned that they had seen smoke issuing from the new Bogosloff — or, rather, from the position of the Bogosloff — some time in 1882: the exact date could not be obtained.

GEORGE DAVIDSON,

Assistant U.S. coast and geodetic survey.

THE DANISH EXPEDITION TO EAST GREENLAND.

THE report of Lieut. Holm has appeared in the *Dagblad* of Copenhagen. He left Nanortalik on the 23d of July last, with a party of thirty-nine

people, nine kayaks, and four umiaks, and reached Fredericksthal, the last European station, the same evening. Here they were assisted and entertained by missionary Broadbeck until the end of July, while the party was detained by the presence of floe-ice in the vicinity of Cape Farewell. From the 31st of July until Sept. 11 the party was not much incommoded by ice, only losing three days while detained in Lindenow Fiord.

The charts of East Greenland as far as latitude 61° , where the work terminated, will be notably changed, especially by the discovery of extensive fiords, until now unknown. Their shores are generally bare and vertical, or nearly so. In many places snow lies all summer. The sea-ice reaches to the bases of the cliffs, or even several miles into the fiords. Except at the extreme south, vegetation is even less abundant than in West Greenland, and is sometimes wholly absent. The southernmost of these fiords, some thirty-eight miles long, reaches within ten miles of the head of the Tasermin Fiord, which opens on the western coast. Both are full of ice. South of the sixty-first degree of latitude, and even a few miles northward from it, nothing could be seen of the inland ice characteristic of West Greenland. In that vicinity, from a mountain peak three thousand feet in height on Iluilek Island, they were able to see that the interior of the country for a great distance was composed of grand mountains, often rising over seven thousand feet above the sea.

In the fiords explored in 1883, there were found no remains of buildings erected by the Northmen, except those in Lindenow Fiord, the most southern of all, already described by Broadbeck. A great number of Eskimo ruins were noted in the different fiords. Sixty of these uncivilized natives were met going to trade with the people of West Greenland. They were much less like the typical Eskimo than those of the western coast. The men are almost always tall and slender, with long beards, and at a distance resemble Europeans. Some of them were even handsome, and the women were much prettier than those of West Greenland. In summer they lead a nomadic life, going from one fishing or hunting place to another. In winter several families unite to build huts covered with turf and stones, like those of West Greenland. They spend this season hunting seal and bears.

When the natives of Holm's party arrived at about latitude 61° , they refused to continue farther, fearing that the umiaks might be frozen in, as the ice began to knit together every night. On the most northern point attained, a hut was erected, and a depot made for the use of the expedition during the coming summer. Provisions and several boats were left here, and Holm returned with his party to Nanortalik. Here winter quarters were prepared, and a magnetic and meteorological observatory established. Magnetic observations are to be taken hourly from eight A.M. to midnight; on term days, every five minutes; and from four A.M. to four P.M., every minute. Arrangements have been made for simultaneous observations at the commercial stations of Denmark, in West Greenland.

After the winter quarters had been prepared, it was the intention of Holm to examine the fiord of Fredricksthal, and the region between it and Tasermit, which has not yet been explored with care.

It was his intention to start for the eastern coast about the end of April, or early in May, 1884; and during the winter of 1884-85 some members of the party were to remain there.

HUMIDITY AND CHRONOMETER RATES.

MAJOR-GEN. J. F. TENNANT, of her Majesty's mint, Calcutta, communicated to the Royal astronomical society in November last a paper on humidity as a cause of variation in the rate of chronometers. He had borrowed from the government-stores about the end of March, 1882, a chronometer, by Fletcher of London, which had been some time in India, but had not been cleaned since its arrival, and was said to have a good rate. From a gaining-rate of 6^s.5, which it preserved fairly well for about two months; it suddenly fell to a gaining-rate of 2^s.0; this being the commencement of a succession of rather abnormal fluctuations of rate which Major Tennant carefully observed and recorded for about eighteen months. These rates were first compared with a plot of the published daily mean temperatures of the meteorological observatory, with results not quite satisfactory; for, though it would seem at first sight that the rate depends on temperature, further examination showed that it can do so to a moderate extent only, and confirmed the belief, which Major Tennant had from general impressions, that rate does not depend on temperature. The extraordinary differences of rate at times of nearly equal temperature leave no doubt that there is a periodic change of rate; and the cause of this, Major Tennant believes to be humidity. His first suspicion of this was raised by the sudden fall in rate of this chronometer, in 1883, being coincident with the first heavy rains producing great damp; and by the fact, also, that the same thing occurred the year previous, and that the whole period of low gaining-rate was that of the rains, while the lowest was the warm time at the end of the rains, when the soil is generally loaded with moisture. The same phenomenon recurred. It is, however, much more difficult to compare the supposed cause and effect without special arrangements; and, in any case, it is doubtful whether air-humidity could be more than a rough guide.

If the oil in the arbors of the balance be hygroscopic, it is easy to see that it may become more fluid in damp weather, the arc of oscillation will increase, the balance-vibration take longer, and the chronometer lose; but the momentary humidity of the air will not correspond to the rate, as the temperature does more or less. Major Tennant, remarking the undoubted connection in this particular case, suggests special experimenting in the following directions:—

1°. Are chronometer-oils, or any of them, hygroscopic?

2°. Can they become so by exposure to a tropical climate?

In this latter case he conceives that the climatic influence cannot be imitated in Europe. The effect of the heat, and probably the light, are very destructive of some materials. Vulcanized india-rubber, for example, does not bear exposure in India, though it seems to answer in Europe, even in heat and damp.

Lastly, in estimating the effect of humidity on a given chronometer, it will probably be best to use one of the old hair or grass hygrosopes for the humidity, placing it in the case, enclosed with the chronometer.

DAVID P. TODD.

THE GREAT COMET OF 1882.

THIS comet is one of the most interesting that has appeared for a number of years, owing to its very near approach to the sun-surface, and the resemblance of its orbit to the two great comets of 1843 and 1880. It was a brilliant object in the morning sky in September, 1882. Calculations of the orbit have been made recently by Dr. Morrison, Professor Frisby, and Dr. Kreutz. The periods obtained are as follows: Dr. Morrison, 712.1 years; Professor Frisby, 793.9; Dr. Kreutz, 843.1. These periods are, however, somewhat uncertain, owing to the peculiar nature of the nucleus of this comet. Instead of being a single bright body, there appeared to be a row of small nuclei, so that it was a mere matter of judgment with the observer what part of the comet he should observe. The observations were naturally made upon the middle of the row of points, and it is not possible to say with certainty that this corresponded to the centre of gravity of the comet. It is worthy of note, that bright comets are recorded in the year 370 B. C. and in A. D. 1132, both of which could be reconciled with the great comet of 1882 by supposing the period of 751 years.

THE WORK OF THE CAMBRIDGE ARCHAEOLOGICAL MUSEUM.

THE trustees of the museum of American archaeology and ethnology, founded by George Peabody, held their annual meeting on the 18th of February, the anniversary of the birth of the founder. The Hon. Robert C. Winthrop, president of the board, presided; and Professor Asa Gray, Dr. Henry Wheatland, Mr. John C. Phillips, Mr. Samuel H. Scudder, and Mr. F. W. Putnam (the curator of the museum) were present. The Hon. Stephen Salisbury of Worcester was prevented by temporary illness from attending, and the Hon. Theodore Lyman was unable to leave his duties in Congress.

The report of the treasurer, Mr. Phillips, showed that the \$150,000 given by Mr. Peabody is well invested. Of the income of \$8,334, only \$5,186.50 was expended on account of the museum: \$3,110 belonged to the building-fund, and the remaining \$37.50 was expended on insurance. Mr. Winthrop

called attention to the wide-spread operations of the museum, which had so far exceeded the early expectations of the trustees as to have entirely outgrown its foundation. The original fund, although a munificent gift at the time, is now inadequate, owing to the unforeseen growth of the science. He hoped that in any account which might be given of this meeting, it would be clearly stated that this trust is in no way connected with the Archaeological institute of America, with which it has, no doubt, been confounded in some minds.

Mr. Putnam, the curator, presented his report of the operations of the year, in which he dwelt at length on the explorations which had been carried on by means of the subscriptions of several patrons of science. With about \$1,600, the balance of the special subscription-fund of 1882-83, and less than \$1,000 spared from the income, work has been continued in Nicaragua and Ohio, and, in a very limited manner, in Tennessee and North Carolina.

The work in Nicaragua has been conducted for the past five years by Dr. Flint, who has made very important collections from the ancient shell-heaps and burial-places. During the past year, on Deadman's Island, in a trench lined with stones, he found a burial-jar containing decayed human bones, with old Venetian beads, and two gold ornaments like those found in the graves at Chiriqui. This shows that gold ornaments of this type were used by the natives of Nicaragua after the Spanish conquest had furnished them with glass beads. As they are exceptional among Nicaraguan antiquities, and are identical with those from farther south, it is probable that their original source is Chiriqui. Dr. Flint has copied successfully many pictographs and cave-inscriptions, some of which are of great antiquity. But the most interesting discovery is what Dr. Flint believes to be human footprints in clay under several layers of lava-rock, on the borders of Lake Managua. Under date of Dec. 24, 1883, Dr. Flint writes that he has cut out several of these footprints, which, with fossil leaves from the same stratum, are now on their way to the museum.

The work in the Little Miami valley has been continued with remarkable success, and has resulted in discoveries of far greater importance than could have been anticipated from previous exploration of the mounds. A year ago attention was called to some early results of this exploration; but now, just as the means for continuing explorations are wanting, the discovery has been made, that, important as these mounds have proved to be, as much of interest is to be found beneath them. At the bottom of the largest mound, under a layer of burnt clay enclosed by a stone wall, trenching has brought to light a series of pits six to seven feet deep. These pits are connected with tunnels of clay a foot in diameter and seven to eight feet long, ending in upright tubes five inches in diameter and two feet long. Fine ashes were found on the bottom of the tunnels or flues, and on the sides a glossy substance, as if the product of condensation and crystallization of vapors. The pits were partly filled with ashes containing minute

pieces of burnt bone, and the sides and bottom bore marks of fire. Two pits had dome-like covers of clay, in one of which were two small holes. A tube of clay opened into one pit opposite the flue. Although these facts seem to point out the manner of burning the dead in use among the people who built this group of tumuli, it would be premature to make such an assertion. This work has been under the direct supervision of the curator and Dr. Metz. It is unquestionably the most thorough and important exploration of a particular group of earth-works yet made in Ohio. Many mounds varying in structure, and evidently made at widely different times, have also been carefully opened; and several Indian burial-places and village sites have been examined. When this work in the Little Miami valley is completed, it will bring us nearer the solution of the problem, who built the mounds? Guessing will still go on, but thorough exploration by careful hands alone can give to science the answer it demands. The work is far more extensive than most persons imagine. The land has been hired by the museum, with exclusive right of excavation. It will be necessary to dig over a large area, including the whole altar-group, to trace in a systematic manner the underground works. A number of laborers will be required for months to come. Funds are therefore needed at once, that the work may be continued without interruption.

In closing his report, the curator urged the necessity of some immediate action for the preservation of the interesting monuments of aboriginal art, scattered over our western states. Probably nearly all which are in such condition as to be worth saving could be purchased at fair prices. Their owners, as a rule, would be glad to see the ancient works preserved, but do not feel able individually to sacrifice so large an amount of farming-land for the purpose. Special mention was made of the Hopeton works, with its twelve-foot embankments and large square and circle; the Cedar-Bank works, which are still well preserved, in the Scioto valley; the Great Serpent, 1,415 feet long, the only work of the kind in the country; the Stone Fort, enclosing fifty acres, known as Fort Hill, in the Brush-creek valley; Fort Ancient, with its four miles of wall, the largest of the many ancient fortifications in the United States, on the Little Miami River; Cahokia Mound in Illinois, the great pyramid of the Mississippi valley, and the largest tumulus in the country, nearly one hundred feet high, and covering an area of over eleven acres; and the singular group of low effigy-mounds in Wisconsin. Some of these mounds are more than a thousand feet long. Many other ancient works are equally worthy of preservation; but those mentioned had been recently inspected by the curator. With every year that passes, some mound or great embankment is levelled for economic purposes, or for the easier cultivation of the land; or the old walls of the hill-forts, which have stood for untold centuries, are thrown down. Forty years ago many of the works were perfect which are now nearly obliterated. Our children will not be able to trace their sites, unless destruction is immediately checked.

VORTEX RINGS.

A treatise on the motion of vortex rings. An essay to which the Adams prize was adjudged in 1882, in the University of Cambridge. By J. J. THOMSON, Trinity college, Cambridge. London, 1883. 19 + 124 p. 8°.

THOSE cases of fluid motion in which no rotational motion is present, are, as is well known, readily amenable to analysis. Helmholtz¹ first called attention to the nature of the analysis by which rotational motion must be treated. This memoir was followed by Sir William Thomson's suggestive paper on vortex atoms,² and finally by his important mathematical memoir on vortex motion.³ The very great mathematical difficulties of the theory have operated to prevent almost entirely farther progress in the investigation of this otherwise alluring subject. To the best of our remembrance this essay is the first systematic attempt, since 1869, to enlarge our knowledge of the theory of vortex rings. How great the difficulties to be vanquished are, may be imagined from the appearance of the pages of the essay before us, which bristle with periodic series and complicated expansions.

The scope of the essay may perhaps be best apprehended from its opening paragraphs, which we quote:—

"The theory that the properties of matter may be explained by supposing matter to be collections of vortex lines in a perfect fluid filling the universe has made the subject of vortex motion at present the most interesting and important branch of hydrodynamics. This theory, which was first started by Sir William Thomson as a consequence of the results obtained by Helmholtz in his epoch-making paper, *Ueber integrale der hydrodynamischen gleichungen, welche den wirbelbewegungen entsprechen*, has *a priori* very strong recommendations in its favor; for the vortex ring obviously possesses many of the qualities essential to a molecule that has to be the basis of a dynamical theory of gases. It is indestructible and indivisible; the strength of the vortex ring, and the volume of liquid composing it, remain forever unaltered; and if any vortex ring be knotted, or if two vortex rings be linked together in any way, they will retain forever the same kind of be-knottedness or linking. These properties seem to furnish us with good materials for explaining the permanent properties of the molecule. Again: the vortex ring, when free from the influence of other vortices, moves rapidly forward in a straight line. It can possess, in virtue of its motion of translation, kinetic energy; it can also vibrate about its circular form, and in this way possess internal energy: and thus it affords us promising materials for explaining the phenomena of heat and radiation.

"This theory cannot be said to explain what matter is, since it postulates the existence of a fluid possessing inertia; but it proposes to explain, by means of the

laws of hydrodynamics, all the properties of bodies as consequences of the motion of this fluid. It is thus, evidently, of a very much more fundamental character than any theory hitherto started: it does not, for example, like the ordinary kinetic theory of gases, assume that the atoms attract each other with a force which varies as that power of the distance which is most convenient; nor can it hope to explain any property of bodies by giving the same property to the atom. Since this theory is the only one that attempts to give any account of the mechanism of the intermolecular forces, it enables us to form much the clearest mental representation of what goes on when one atom influences another. Though the theory is not sufficiently developed for us to say whether or not it succeeds in explaining all the properties of bodies, yet, since it gives to vortex motion the greater part of the interest it possesses, I shall not scruple to examine the consequences, according to this theory, of any results I may obtain.

"The present essay is divided into four parts: the first part, which is a necessary preliminary to the others, treats of some general propositions in vortex motion, and considers at some length the theory of the single vortex ring; the second part treats of the mutual action of two vortex rings which never approach closer than a large multiple of the diameter of either; it also treats of the effect of a solid body immersed in the fluid on a vortex ring passing near it; the third part treats of knotted and linked vortices; and the fourth part contains a sketch of a vortex theory of chemical combination, and the application of the results obtained in the preceding parts to the vortex-ring theory of gases.

"It will be seen that the work is almost entirely kinematical: we start with the fact that the vortex ring always consists of the same particles of fluid (the proof of which, however, requires dynamical considerations), and we find that the rest of the work is kinematical. This is further evidence that the vortex theory of matter is of a much more fundamental character than the ordinary solid particle theory; since the mutual action of two vortex rings can be found by kinematical principles, whilst the 'clash of atoms' in the ordinary theory introduces to forces which themselves demand a theory to explain them."

The great difficulty which inheres in the vortex theory of chemical combination is to sufficiently account for what takes place at the instant of chemical union by showing that vortex atoms can, without supposing other forces than those due to their motion, have any such attractions as are known to exist, and especially to account for the enormous quantities of heat liberated in many cases of chemical decomposition.

The author, however, postpones all extended application of the vortex theory of atoms to the dynamical theory of gases for consideration in a future paper, but, among other important conclusions, states that the phenomena attending the diffusion of gases through a porous diaphragm which separates portions of gas at different temperatures will probably furnish a crucial experimental test between the vortex atom theory and the ordinary kinetic theory.

¹ *Crelle's Journ.*, 1858, and translated by Tait, *Phil. mag.*, 1867.

² *Phil. mag.*, 1867.

³ *Edin. trans.*, 1869.

THE SILK INDUSTRY IN THE UNITED STATES.

Silk-manufacture in the United States. Compiled by WILLIAM C. WYCKOFF, special agent of the tenth census.

UNDER the above title, Mr. W. C. Wyckoff has published a volume containing his report as special agent of the census of 1880, the tenth annual report of the Silk association of America, and a directory of silk-manufacturers. The first of these reports is reprinted on account of the very small edition of the bulletin issued by the census office, and deserves more notice than it has received, on account of its admirable historical account of the numerous attempts at silk-culture in this country, and of the rise of silk-manufacture. The interest in silk-culture has steadily grown of late years, while the interest in silk-manufacture was scarcely more marked during the early struggles to establish the industry than at this present time of tariff-reform agitation.

In the work before us, the first introduction of silk-culture into America is traced back to the Spanish conquest of Mexico. Mulberry-trees were planted near the city of Mexico by order of Cortes shortly after 1522; and in 1531 a quarter of an ounce of eggs was sent on public account from Spain to Francisco de Santa Cruz, a citizen of Mexico. The eggs were reared by Auditor Diego Delgadillo with the best of success, and two ounces were returned by him to Francisco. He was accused, however, of selling the remainder of the eggs, which were the property of the crown, to others for sixty dollars an ounce, was tried and convicted. This carries the beginning of silk-culture in America nearly a century back of previous records. The industry flourished for a while in Mexico, supplying the demands of the people, and even giving rise to a certain amount of export to Peru; but, by the end of the sixteenth century, few traces of its existence were left.

Early in the seventeenth century James I. of England, jealous of the growing prosperity of silk-culture in France, resolved upon its introduction into England and the American colonies. In 1619, after one disastrous attempt had been made ten years previous, eggs were received in Virginia from the Royal gardens at Otland; and the settlers were enjoined, by promises of aid for diligence, and threats of punishment for negligence, to undertake the culture of the worms. Meanwhile the cultivation of tobacco was discouraged in every possible way. Nevertheless, the success of the silk-industry was but slight. Some silk was

grown, as it was quoted among the market-prices of commodities grown in Virginia at that time; but, in spite of all encouragement, the industry did not flourish. Calculations were made whereby it was shown that the labor of slaves employed in growing silk would produce about twice as much value as in planting sugar and tobacco; and one writer even advised the sending of all the paupers and small criminals of the old country to the colonies to engage in the culture.

In South Carolina but little more was done; and in the twenty-five years of greatest production — between 1731 and 1755 — only 251 pounds were exported. Georgia did somewhat better. In 1735 a plot of ground near Savannah was planted with mulberries and vines at the public expense. In 1744 a filature was built and bounties were offered, and from 1750 to 1772 considerable amounts of silk were exported. Then came the war of the revolution, and mention of silk-culture for a time ceases.

Mr. Wyckoff then traces the early attempts to introduce the culture into New England. In each case the culture is traced from its rise in any particular colony to its extinction, and the various causes for failure are discussed. Some new facts are added to this portion of the work; but in the main it substantially coincides with other accounts, notably with Dr. Brockett's 'Silk-industry in America' (1876), — a not surprising fact, since both authors relied upon the same library. Nevertheless, this portion of the work, covering the most interesting periods in the history of the industry in America, is thoroughly concise, and full of valuable suggestions. The growth of the industry is followed, and shown to have been steady after the revolution, with no encouragement in the way of premiums or bounties. Connecticut became the chief seat of production, and the silk was consumed mainly in the manufacture of sewing-silk. This part of the history — during the close of the last and the beginning of the present century — shows pretty plainly, that, without interference or discriminating legislation, silk-culture and silk-manufacture would develop co-ordinately. During the third and fourth decades of the present century the general interest in the subject increased; and the encouragement given by the various states and by Congress, until the *Morus multicaulis* furore undid them all in 1839, transcended any similar efforts since made. In 1826 we find that three-fourths of the families in Mansfield were engaged in raising silk, and made annually, per family, from five to fifty pounds, or even a hundred pounds,

of 'raw silk.' The largest amount of raw silk produced in this country in any one year is given as thirty thousand pounds, in 1841.

There is a tendency, on Mr. Wyckoff's part, to intensify the dark side of silk-culture, and to depreciate the quantity and quality of silk produced, — a tendency that is natural, and doubtless unconscious, in an agent of an association of manufacturers. In most cases he makes the amount of silk raised much smaller than given by common report: but he does so in some instances by assuming that the term 'raw silk,' or 'raw-silk balls,' in older works and reports, meant cocoons, or that there was 'neglect in discriminating between cocoons and raw silk;' also by calculating that from ten to fourteen pounds of cocoons are necessary to make a pound of reeled silk. He by no means makes it clear that the term 'raw-silk balls' really meant cocoons; as it might apply to the twisted hanks of reeled silk, and the term 'cocoons' was in use at that time. It is also certainly not justifiable to assume that the cocoons were necessarily fresh, as they are not thus handled and marketed. This he does, however, in his estimates (p. 24). Four pounds of choked cocoons to a pound of reeled silk is a liberal estimate, and would give us in 1766, when twenty thousand pounds of cocoons were produced, five thousand pounds of 'raw silk;' while the maximum amount Mr. Wyckoff allows in any one year prior to 1772 is 'rarely exceeding a thousand pounds.' While sometimes misleading, therefore, this tendency to look on the dark side of silk-production has resulted in demonstrating some exaggeration and mis-statement on the part of earlier writers; and the establishment of the truth or falsity of such statements, which have again and again been put forth, is one of the most meritorious features of the work. The most striking case in point is where (p. 25) the oft-quoted statement as to the export of ten thousand pounds of raw silk in 1759 is pretty conclusively shown to have been based upon such confusion of terms and mis-statements as above indicated.

The summing-up of the present condition (1880) of silk-culture in the United States is worthy of quotation: —

"An inquiry was attempted by the writer to ascertain the amount of raw silk raised in the United States during the census year ending June 30, 1880. It was soon determined that the expense of making such an investigation thoroughly would be more than the result could be worth. The only instances of the use of native silk in manufacture were at Williamsburg, Kan., and at Salt Lake City, Utah. The latter experiment proved financially a failure, the raw silk costing much more than the Asiatic product. It may

however be stated in a general way, without pretension to accuracy, that the amount of reeled silk produced in Utah territory during the year was less than a thousand pounds; the amount in Kansas was less than five hundred pounds, and the product in no other state was more than half as much. Missouri and North Carolina probably came next in amount of cocoons raised, and after those states Pennsylvania and New Jersey, the quantities produced there and in scattered localities throughout the country being inconsiderable."

With the exception of the penchant already alluded to, in favor of the manufacturing as against the productive part of the silk-industry, the author has done his work so well that it will remain as the best monograph on the subject we possess. It is, in fact, a model report, the material for which has been gathered with care and comprehensiveness, and put together in such compact and concise form that it will serve as a cyclopaedia for all future reference, and render it extremely difficult for future writers to add any thing of consequence.

We notice but one clerical error of any importance. 'Julius Stanislaus,' in the list of authors (p. 39), should be 'Stanislas Julien.' He was a member of the French institute, and professor of Chinese literature in the College of France.

No one can read this report without feeling that the silk-manufacture of the country has been built up to its present importance by our protective policy; and at first blush this would seem to be a very strong argument in favor of that policy. But it has at the same time had the effect to throttle and destroy the production and concomitant reeling of silk. The one industry is protected at the expense of the other. 'Raw silk,' as applied in the trade, is a misnomer: it should apply to the simple fibre upon the cocoon, whereas it really applies to the reeled silk, which is as much a manufactured article as any woven or sewing goods, having gone through an elaborate process by means of special skill and complicated machinery. On its successful establishment the silk-producing industry may be said to depend. Nothing is more clearly demonstrated by Mr. Wyckoff's report than that the chief cause of failure in this last, next to no reeling at all, has been the bad reeling of domestic silk. There was never any difficulty in rearing the worms, or in getting silk of the best quality; and, when good reeling could be had, 'native silk was found to be of superior quality and strength' (p. 35). Why, therefore, it will be asked, should one kind of manufacture be protected from foreign competition, and not the other? If protection is beneficial to the people in the

one case, why not in the other? With a native food-plant (*Maclura aurantiaca*) now known to be available over most of our domain, with a rapidly-increasing population, with increasing means of communication, and with the settlement of sections of the country that by climate are pre-eminently adapted to silk-culture, the present period has advantages for this culture possessed at no other period, and the question is pertinent. We do not propose to introduce a homily on free trade; but we think that the chief answer that can be given to the question is, that our silk-manufactures are established, and give employment to a large number of operatives, while silk-culture as an industry amounts to so little that there is nothing to protect. The same could have been said of silk-manufacture while it was struggling for establishment, and means little more than that we must keep up a discriminating policy, simply because we have begun it; and the more powerful and wealthy the manufacturing interest becomes, the more certain will it be kept up. This is the secret, in a nutshell, of the failure of silk-culture at the present time; and the prospect for what might otherwise become a valuable productive industry is certainly gloomy.

SCRIBNER'S WHERE DID LIFE BEGIN?

Where did life begin? a brief inquiry as to the probable place of beginning and the natural courses of migration therefrom of the flora and fauna of the earth. By G. HILTON SCRIBNER. New York, Charles Scribner's Sons, 1883. 6+64 p. 12°.

THIS little monograph is a full summary and straightforward statement of the principal grounds of the theory of the arctic origin of the plants and animals of the northern hemisphere. These grounds, in more condensed statement, are as follows: on any planet, organic life would first appear in the region first suited for its reception. On a planet cooling from an incandescent state, the polar regions would first acquire a habitable temperature, both because their deficiency of solar heat would accelerate cooling, — that deficiency being increased by polar flattening, which renders the sun's rays more oblique, and increases the radiating surface of the polar sides, — and because, underneath the polar sides, there is less matter to be cooled than underneath the equator. On our earth the polar regions are now too cold for life, and hence they have passed through the life-sustaining stage; and this was while more equatorial regions remained too hot. As the life-sustaining isothermals moved equatorially, animals and plants mi-

grated correspondingly. The progress of climatic change was not more favorable to this faunal and floral migration than were the southward bottom flow of water in the general oceanic circulation, and the general meridional trend of the continental and oceanic configuration, or the prevailing surface-movement in the atmospheric circulation. All these conditions oppose transmeridional migrations. Confirmatory of these deductions are numerous facts of observation, — such as similarity of the fauna and flora at all parts of the same parallel of latitude; the remains of tropical and subtropical animals and plants in arctic regions; the degenerate condition of certain arctic species, as whales, seals, and others; and the fundamental affinities of different tribes of plants and animals which testify to a common origin.

Undoubtedly some of these considerations are entirely valid, and confer upon the theory a claim to sober consideration, not to mention the authority of names previously subscribed to it. What a hesitating believer would like to know further, is, whether the inferior polar radius of the earth would really accelerate or retard polar cooling, and whether the circulations of the sea and atmosphere have been such as to promote the migrations of plants and animals from high polar to equatorial latitudes. The deductions based on progress of planetary cooling are plausible; but the queries arise, whether circulations did not exist in the fluid planet before incrustation as well as in the fluids existing after incrustation; and whether such circulation must not have maintained polar and equatorial surface temperatures so nearly equal as to permit nearly simultaneous incrustation in all latitudes; and then, whether, after general incrustation, the crustal arrest of radiation must not have speedily diminished subcrustal influence to such an extent that climate depended chiefly on solar radiation, since less than half a mile of crust would fail to conduct sufficient heat to affect surface temperature more than a small fraction of a degree. Then, on the side of inductive data, we have to consider whether the secular southward progress of identical climatic conditions would not be incompatible with that continuity of sedimentary conditions, which, especially in North America, has been traced from the thirty-fifth to the sixty-fifth degree of latitude; and whether a similar progress of identical faunal conditions would not introduce a progressive change in the correlation of life to the age of the strata, leaving the same types in older strata northward, and newer strata southward, while observation testifies that the same Hamilton types,

for instance, stretch from Missouri to Arctic America, and are enclosed in sediments of similar character throughout these limits. Aside from defects of particular arguments, and aside from any weight attributable to this essay, the question is one which will undoubt-

edly provoke competent and deliberate discussion. Mr. Scribner's monograph is well written, with some local diffuseness, and an occasional sentence of intolerable length, but, on the whole, a timely, suggestive, and pleasant little volume.

INTELLIGENCE FROM AMERICAN SCIENTIFIC STATIONS.

GOVERNMENT ORGANIZATIONS.

Geological survey.

Rocky Mountain division. — Upon the organization of the survey, the area of the United States was divided into eight districts, in order that the progress of the work might be systematically facilitated. Of the four western districts, the 'Rocky Mountain district' includes the state of Colorado and the territories of New Mexico, Wyoming, and Montana.

Geologic work. — Colorado has been the principal field of geologic activity in the district; and the work has been carried on under the supervision of Mr. S. F. Emmons, who is the geologist in charge, with headquarters at Denver. The mining-geology of the state has been made the subject of special study, and the investigations have been confined mainly to questions of direct economic importance. Prior to 1883 the work done was principally in the Leadville and Ten-mile regions. Last season an examination of the Silver Cliff mining-district was undertaken. The geologic work was begun by Mr. Whitman Cross about the 1st of July, and was carried on through the summer, and completed in September. The topographic work had been previously completed. The preparation of the geologic map was intrusted to Messrs. Cross and Chapman, assistant geologists. Messrs. Jacob and Eakins were detailed to report on the mines and ore-deposits, under the personal supervision of Mr. Emmons. Mr. S. S. Sackett was engaged in gathering statistics as to the reduction of the ores of the district, and secured material for a chapter on the mills and reduction-works of the district.

The report on this mining-district will be of especial value, as the Silver Cliff is a mining-camp of abortive processes, a true history of which may well serve as a warning, by pointing out the errors, which there led to the failures in mining and in the reduction of the ores.

From the Silver Cliff district a short trip was made to the Sangre de Christo range, which lies on the opposite side of the valley. This was made with a view to determine the geologic relations of the Silver Cliff ore-deposits to the rocks of the range. Some field-work was also done by Mr. Cross on the mesozoic rocks exposed in the vicinity of Golden and of Morrison. In the Denver coal-basin progress was somewhat retarded by the absence of Mr. Karl, who has charge of the topographic survey of the region.

Although temporarily suspended during the summer, work in this basin can be carried forward during the winter months, when the snow causes the abandonment of the field in the mountainous sections of the state. The map of the basin is to include some thirty square miles, on a scale of one mile to one inch. Information on the subject of the artesian wells in this basin is being secured, and will be embodied in the report. Voluminous rock-collections were made during the season, especially in the Silver Cliff district; and a special trip was made to Buffalo Peaks for the collection of typical specimens of hypersthene-andesite.

Besides the field-work, considerable office-work was accomplished. The notes on the Ten-mile district were worked up, and a geological map and sections of the area were made. Manuscript for the following monographs by the 'Rocky Mountain division' are in advanced stages of preparation: viz., 1°, Geology and mining industry of Leadville, by S. F. Emmons (an abstract of this paper appeared in the second annual report of the survey); 2°, Geology and mining industry of Ten mile district; 3°, Geology and mining industry of the Silver Creek district; 4°, The basaltic mesas near Golden, and their relation to the contiguous tertiary and cretaceous beds. During the season the bulletin on hypersthene-andesite, by Mr. Whitman Cross of this division, was published.

Laboratory work. — The laboratory at Denver is in charge of Mr. W. F. Hillebrand, chemist, who has been busy with the chemical and lithological examination of the rocks collected in the district, and on the ores from the various mining-districts. Some of the details of his work have already been given in *Science*. Mr. Whitman Cross has carried on the microscopical examination of the numerous thin rock-sections made of the rocks collected in the district.

Topographic work. — Mr. Anton Karl has been carrying on the topographic surveys in the district, and during the season of 1883 was in the Elk Mountains, mapping the Gunnison mining-region. His triangulation was based on Snow Mass and West Elk Mountains, two points located by the Hayden survey. These were occupied, and a system of triangulation was extended from them over the whole area surveyed. The principal mines in the Ruby basin, lying between Mount Owen and Irwin Peak, were all located, as well as Anthracite Mountain and the property of the Denver and South Park coal company. Topographical data were obtained for

mapping the Ruby and Irwin regions preliminary to future geologic work. The country lying between Beckwith, Marcellina, and Anthracite Mountains was also worked up, and each of those points occupied, and the valley of Ohio Creek surveyed. In the early part of September, work was begun in Poverty and Washington gulches and in Baxter basin, and the East River valley, between Schofield, Gothic, and Crested Buttes. Fair results were obtained, although

severe snow-storms impeded progress. About the middle of the month Mr. Karl was directed to co-operate with special agent J. A. Bently, of the Interior department, to ascertain the accuracy of the Land-office survey of the Maxwell grant in southern Colorado and northern New Mexico. He was occupied on this work the remainder of the season, and in the latter part of November presented to the court a map prepared by him in support of his evidence.

RECENT PROCEEDINGS OF SCIENTIFIC SOCIETIES.

Chemical society, Washington.

Feb. 23. — Mr. W. H. Seaman exhibited and described a new form of burette, and also a graduated pipette, modelled after the ordinary medicine-dropper. — Prof. F. W. Clarke exhibited a copy of Lothar Meyer's curve of atomic volumes, drawn to large scale, with the most recent data. With it, upon the same sheet, was compared a similar curve of melting-point.

Biological society, Washington.

Feb. 23. — Dr. Elliott Coues read a paper on the present state of North-American ornithology. In discussing the precontemporaneous history of the subject, he defined the following epochs: 1, The archaic (prior to 1700); 2, The pre-Linnean (1700-50); 3, The post-Linnean (1750-1800); 4, The Wilsonian (1800-25); 5, The Audubonian (1825-50); and, 6, The Bairdian (1850+). A number of periods were also defined as follows: 1. The Lawsonian (1700-30); 2. The Catesbian (1730-48); 3. The Edwardsian (1748-58); 4. The Linnean (1758-66); 5. The Fosterian (1766-85); 6. The Pennantian (1785-90); 7. The Bartramian (1790-99); 8. The Vieillotian (1800-1808); 9. The Wilsonian (1808-24); 10. The Bonapartian (1824-31); 11. The Richardsonio-Swainsonian (1831-32); 12. The Nuttallian (1832-34); 13. The Audubonian (1834-53); 14. The Cassinian (1853-58); 15. The Bairdian. The establishment of the American ornithologists' union, he thought, would probably mark the establishment of a new epoch, — one in which the existing intricacies of ornithological nomenclature will be replaced by a consistent system founded upon a rational code: the present is simply a period of transition. Dr. Coues laid before the society the plate proofs of the forthcoming new edition of his *Key to North-American ornithology*.

Mr. C. D. Walcott exhibited a second time the rocks from Maine, containing fossil corals. He stated, that having received a number of additional specimens of the granite-like rock containing fossils, *Stromatopora*, corals, plates of crinoid stems, etc., from Litchfield, Me., he found that he had been incorrect in calling the rock a granite, as it was of sedimentary origin, — a clastic rock, so changed in the specimens examined that it might be called a conglomerate gneiss.

Prof. Lester F. Ward exhibited a specimen of the

'diamond willow,' — a variety of *Salix cordata* occurring in the upper Missouri region, distinguished by a great exaggeration of the scars left by the early growths of limbs which form series of large diamond-shaped cavities along the stems. He also exhibited some canes carved by the people of that region, which show the so-called diamonds in a striking manner. Professor Seaman advanced the theory that these scars are caused by the influence of some fungus or of some insect which lays its eggs in the buds.

Linnaean society, New York.

Feb. 8. — The publication of vol. ii. of the *Transactions* was ordered. — Dr. C. Hart Merriam read a biography of the muskrat (*Ondatra zibethicus*), giving its life-history as noted by him in the Adirondack region of north-eastern New York. The paper was followed by a general discussion as to its differing habits in a less boreal locality. — A translation from the Spanish of Rafael Montes de Oca by L. S. Foster, and the subsequent discussion, developed many interesting facts concerning the *Trochilidae*. — Mr. William Dutcher remarked upon the scarcity of the snowy owl (*Nyctea scandiaca*) this winter on Long Island, and upon the presence in considerable numbers of the thick-billed guillemot (*Lomvia arctica*), as well as the razor-billed auk (*Utamania torda*); while not a single sea-dove (*Alle nigricans*) had come under his observation. His Long Island records for the Ipswich sparrow (*Passerculus princeps*) give the capture of thirty-three specimens since their arrival, Dec. 16, after a severe snow-storm.

Academy of natural sciences, Philadelphia.

Jan. 22. — Mr. F. W. Putnam made a communication on a group of mounds occurring on the Miami River, which in many respects he considered the most important in the country. The methods of investigation, and the objects found in the mounds referred to, were described in detail, and illustrated by means of specimens and photographs. While no doubt exists as to the construction of mounds by some of our existing Indians, those he described had absolutely nothing in common with the more modern structures, except in so far as they indicated the Mongoloid type.

As the essentially fresh-water character of the worm *Manayunkia speciosa* (the forms related to

which are all marine) had not heretofore been unquestionably established, Mr. Edward Potts believed that it would be of interest to record that he had in his possession specimens from the Schuylkill River above the dam, and therefore from absolutely fresh water. The currents produced by the cilia on the tentacles were claimed to be excurrent, and not incurrent, as might have been expected, the feeding processes in some cases being performed by the tentacles themselves.

Jan. 29. — Prof. J. Leidy directed attention to a collection of fossil bones which had been submitted to his examination by the Smithsonian institution. They were obtained at the mine of the American salt company, near New Iberia, La. They chiefly consist of remains of *Mastodon americanus*, of *Equus major*, of an *Equus* not distinguishable from the domestic horse, and of *Myloodon Harlani*. Of the *Mastodon*, the collection contained well-preserved molar teeth, and characteristic fragments of bones. Of the *Equus major*, there are vertebrae, fragments of long bones, and a number of teeth. Of *Myloodon*, there are several molar teeth, vertebrae, and other bones, mostly fragments. Among these are two mature and well-preserved tibiae, the best specimens yet discovered of the species. They are identical in form and size with those of *M. robustus*, indicating *M. Harlani* to have been a species of the same size as the former.

Prof. J. Leidy stated that he had recently received for examination, from Mr. B. W. Thomas of Chicago, several glass slides with mounted specimens of sand. These were obtained by washing clay from the bowlder drift of Meeker county, Minn. In the specimens Professor Leidy recognized some well-preserved and characteristic foraminifera, of which two forms appeared identical with *Sextularia globulosa* and *Rotalia globulosa*, now living in the Atlantic Ocean. The fossils Mr. Thomas supposes to be derived from a soft yellow rock, cretaceous shale and lignite forming part of the drift. He also reports the finding of fragments of marine diatoms in the clay. Professor Heilprin suggested that the foraminifera referred to had probably been washed from underlying Silurian rocks.

Feb. 5. — A communication was read from Miss S. G. Foulke, describing a new species of rotifer under the name *Apsilus bipera*. The specimens were found in Fairmount Park; and, in common with all members of the genus, they possess, instead of rotatory organs, a membranous cup or net, which is used for the capture of food. The specific distinction of the form now described consists chiefly in the structure of the net, the presence of a true stomach in addition to the usual crop, and the presence of cilia inside the net. It was proposed to unite the forms *Apsilus lentiformis* Meczinchoff, *Dictyophora vorax* Leidy, *Cupelopagus lucinedax* Forbes, and the species now described, under one genus, *Apsilus*, in consequence of their strong points of resemblance. These are, briefly, the presence of two eye-spots, of a membranous crop instead of rotatory organs, of a mastax exactly alike in all, and the absence of a tail or foot-stalk.

Prof. H. Carvill Lewis announced the discovery of fossils in the triassic red shale from the neighborhood of Phoenixville, and gave a preliminary notice of them. They occurred in soft red rock at the southern entrance to the new tunnel, in strata dipping 10° N. 30° W., which would place the bed considerably below the strata of the old tunnel, perhaps a thousand feet, unless faults intervened. The specimens consist of some five distinct species of lamellibranch shells, a ganoid fish, some plants, and a doubtful fragment of a saurian bone. Among the shells are two species of *Unio*, somewhat resembling *U. calceolus* and *U. lanceolatus* of Lea. These are, of course, of fresh-water origin, and are found in single and double valves, and open. Three species of marine shells also occur in the collection; and the apparent commingling of fresh-water and marine species was referred to as an interesting fact. The shells, which in most instances lay parallel with the bedding, were frequently distorted by the movement of the shale. The *Unios* were regarded as probably the most ancient yet discovered, some specimens found in New Mexico being of later age. The coal-plants represented are fresh-water species, but reference was made to a triassic marine fucoid described by the speaker some years ago. The fish belongs to the lepidogonoids, and resembles the *Catopteris gracilis* of Redfield.

Engineers' club, Philadelphia.

Jan. 19. — Mr. Wilfred Lewis read a paper upon the resilience of steel, reviewing some of the means employed for the storage of energy, and showing the place occupied by steel among them. Among the means now employed, compressed air, hot water, and the storage battery were cited from an English writer as being about equal in value, and as giving out about 6,500 foot-pounds of work per pound of material used. Steel springs, according to the same writer, were said to yield about 18 foot-pounds per pound. In this connection, the project of using steel springs as a motor for street-cars was referred to as the most hopeless of all possible means of locomotion. To test the accuracy of this statement in regard to steel, several experiments were made by the writer upon tempered specimens, both for tension and flexure. Contrary to expectation, the highest results were shown by the flexure of a small spiral clock-spring weighing 2,040 grains, which gave out, when wound up, about 45 foot-pounds of energy; or, in other words, 154 foot-pounds per pound. The transverse strength of this steel, within the elastic limit, was found to be about 300,000 pounds per square inch, and its modulus of elasticity about 30,000,000. Such extraordinary strength, with such a low modulus, was so far beyond conjecture, that it seemed to give a new hope for the success of the project referred to; but, after making the necessary allowances for weight of car and efficiency of driving mechanism, it was found that not more than about 20 foot-pounds per pound of car would be available for locomotion. It was therefore improbable that such a car could ascend a hill over twenty feet high. It was also a matter of

doubt, whether larger springs could be made to show results which would even approach these figures; and on this account the experiments about to be tried might be looked for with some interest. — Mr. H. C. Lüders exhibited specimen of rolled and annealed phosphor-bronze of maximum ductility, and consequently of minimum tensile strength, and submitted the following data of the test thereof: length, 2"; diameter, 0.57"; subjected to a strain of 13,620 pounds, equivalent to 53,400 pounds per square inch; elongation, 70.5%; reduced area at point where fracture would occur, 0.3"; elastic limit, about 18,000 pounds per square inch. Hard-rolled rods, tested without turning off the surface, have shown a tenacity exceeding 90,000 pounds per square inch. — Mr. Howard Murphy presented for Mr. Louis C. Madeira, jun., the Record of American and foreign shipping, containing an interesting set of drawings for the details of construction of iron ships. — Mr. Percival Roberts, jun., gave some account of the results of experiments, now being conducted by Mr. James Christie at Pencoyd, upon the relative elasticity of iron and steel structural shapes.

NOTES AND NEWS.

WE noticed a fortnight ago the presentation of the Lyell medal of the Geological society of London to Professor Leidy; and we now learn that the council of the society at the same time awarded to Mr. Leo Lesquereux the sum of twenty pounds sterling from their Barlow Jameson fund, in recognition of the value of his services to geological science. The great extent and value of Mr. Lesquereux's contributions to our knowledge of the fossil flora of North America are well known, and will be still better appreciated when his volume on the tertiary plants, now completed, but not yet distributed, shall be issued.

— Any contributions that American biologists may feel disposed to make toward the Hermann Müller foundation, referred to in our last issue, can be sent direct to the treasurer of the committee, Wilhelm Thurmman, Lippstadt, Germany, or they will be received for and forwarded by Professor William Trelease, Madison, Wis.

— The death (March 2) is announced of Isaac Todhunter, whose name has been a terror to the average college-student of the present generation. He was born at Rye in 1820, and was senior wrangler in 1848. A large portion of his energy was devoted to the production of the invaluable mathematical text-books and treatises which are so well known.

— Capt. Bernard, in the course of a journey into the far interior of Algeria, twenty kilometres north of the Bou Saada River, found a singular flat-topped butte whose elongated rocky summit rises sixty-five feet vertically from the talus which crowns its sloping base. This place, called by the Algerians 'El Gueliaa,' forms a rocky table one hundred and seventy-five feet wide by six hundred feet long, reached by a stairway cut on the northern side. On this plateau has been erected a structure, still in a remarkable state of

preservation, and, from the nature of its materials, apparently of Roman origin. On the east is a large rectangular stone building, containing eight or ten apartments opening upon an inner court. North of this building a vaulted cistern is dug in the rock: sixty feet to the west are two others, side by side, one vaulted over, and the second open to the sky. It is very difficult to say how these cisterns were filled, as there are no springs, or traces of wells, in the vicinity. It was evidently a post established for some special purpose. At Mesaad oasis a hillock thirty or thirty-five feet high bears the broken remains of a Roman gate. The Arabs have tunnelled or ditched the hillock for brick-clay; showing, that beneath the Roman remains now so long abandoned, and over the beds of chalk, salty earth, and clay, which form the mound, there are abundant remains of an earlier occupation, apparently for a considerable period, by a race whose stone weapons and tools, fragments of stone and ivory, and other rejectamenta, are their only memorial.

— The expedition charged by Russia with the task of exploring the ancient bed of the Oxus has concluded its work. The former path of the stream has been subjected to careful levelling from Khiva to the Caspian; proving that it is possible to turn the river into its old course only at the expense of a canal two hundred kilometres long, which is equivalent to a permanently adverse decision on its practicability.

— Signor F. P. Moreno, director of the anthropological museum of Buenos Ayres, was authorized in 1882 to undertake a journey into the interior of Bolivia for purposes of anthropological study. He now reports having visited the provinces of Cordoba, San Luis, and Mendoza as far as the slope of the Andes. During a year's travel he has studied the modern, as well as the traces of the former, inhabitants, and has exhumed in many places bones, weapons, inscriptions, and relics of burials, and has made plans and photographs of the remains of ancient villages. He believes he has obtained full material for a study of life in these regions before the Spanish conquest. He visited the whole extent of the so-called road of the Incas to the Uspallata Pass, when compelled to return by the advent of winter, and has pretty thoroughly explored the range of the same name.

— The material accumulated by the Krause brothers in Alaska, 1881-82, is being rapidly worked up. In the *Botanisches centralblatt* (Cassel, 1883, Nos. 41-43) Karl Müller publishes an account of the mosses of the Chukchi peninsula. He finds twenty-eight new out of seventy-five species collected, certainly a rather unusually large proportion. One of these, a cleistocarpous form allied to *Voitia*, is erected into a new genus by the name of *Krauseella*.

Dr. Hartlaub, in Cabanis's journal, enumerates the birds obtained at the head of Lynn Canal, near the mouth of the Chilkat River, S. E. Alaska. *Lagopus leucurus*, *Certhia familiaris*, *Dendroica Townsendi*, *Sialia arctica*, *Chrysomitris pinus*, *Sphyrapicus ruber*, and *Tinnunculus sparverius* are noted as new to the region, though several of them may be only occa-

sional stragglers. The last mentioned has been observed on the Aleutian Islands.

In a late number of the *Deutsche geographische blätter*, Dr. Arthur Krause gives an interesting account of the houses of the Tlinkit Indians, their methods of building, tools used, and modes of ornamentation. Iron was found at a very early date in the possession of the natives, but was without doubt procured by them from the Russian and Hudson Bay traders by a long but rapidly executed series of transfers from one band or tribe to another. In one year measles penetrated from British Columbia to Fort Yukon and beyond, and trade would take little longer.

Dr. Arzruni has reported on the minerals of the expedition in a paper read before the Gesellschaft für vaterländische kultur in Breslau. The rocks from widely separated portions of the territory indicated analogous geological structure, being chiefly of the oldest crystalline formations,—rocks belonging to the granite series, crystalline schists, and late tertiary volcanic ejections. Remarkable garnets were obtained from Fort Wrangell, and various gold ores from near Sitka.

—The Natural science association of Portland, Ore., has secured new quarters, and hopes soon to establish yearly courses of lectures. The annual address was given Feb. 6, by Prof. L. F. Henderson.

—Dr. D. G. Brinton, the well-known archeologist, has been elected professor of ethnology and archeology by the council of the Academy of natural sciences of Philadelphia, and is making arrangements for the delivery of a course of lectures on his specialty in connection with the department of instruction of the academy during the coming spring.

—Four scientific conventions are to be held in Washington in May,—that of the American medical association, the American surgical association, the American climatological association, and the American fish cultural association.

—The success of the borings for artesian wells at Denver, Col., seems to have encouraged the people of Montana to experiment in the same direction. A boring at Miles City, Montana Territory, on the Yellowstone River, struck flowing water at a depth of three hundred and forty-one feet. An analysis of the water proves it to contain more than sixty grains of carbonate of soda to the gallon. A second well has reached the depth of three hundred and twenty-one feet, without a flow of water. At Billings, nearly a hundred and fifty miles farther up the Yellowstone, a boring has been carried to a depth of nine hundred feet without success, but will be carried still farther down. At Helena, also, a well is being sunk; but work has been postponed until spring.

—Prof. W. Kitchen Parker gave the first of a course of nine lectures on mammalian descent, at the College of surgeons on Feb. 4. His remarks were of an introductory character, and were intended to aid the listener in comprehending the substance of the subsequent lectures. The subject of descent was viewed

from an embryological and purely evolutionary standpoint. The classification of the mammalia employed is that now generally in vogue among mammalogists, the class being divided into Prototheria, Metatheria, and Eutheria. It is to the consideration of the first and second of these sub-classes, and to the Ineducabilia among the Eutheria, that the majority of the lectures will be devoted. The lecturer expressed his belief in the former existence of a group of generalized forms, such as Huxley has described under the name of Hypotheria. Professor Parker's style is simple and pleasing, and, in the introductory lecture, highly poetical. His sentences are replete with biblical allusions, some of which border on the comical. He described the Metatheria, for example, as looking from the summit of their Pisgah toward the promised land of the Eutheria, into which they were never to enter.

—Mr. W. F. Denning was led to conclude, from certain markings discerned on the planet Mercury in the mornings of November, 1882, that its rotation-period is not accurately given in the text-books; the period of twenty-four hours derived from the observations of Schroeter and Harding, about the beginning of the present century, being apparently about one hour too short. His suspicion is now confirmed by a communication from Signor Schiaparelli, who has been very successful during the last two years in observing definite markings on Mercury, and who pronounces the planet's period of rotation, as usually given, 'very far from the truth.' His forthcoming memoir on Mercury is expected to give some very interesting details of the physical aspect of this planet. The necessarily unfavorable circumstances attending all observations of Mercury, make it not to be wondered at that little or nothing is known of its surface-phenomena; but Mr. Denning regards it as obvious that the markings are of a fairly distinct character, and likely to prove a fruitful subject for further investigation. He remarks that the general aspect of the disk, as seen in November, 1882, reminded him forcibly of Mars; and the definite nature of the spots may therefore be readily imagined. He thinks the dark spots and shadings may be regarded as fairly permanent, while the white spots are influenced by rapid variations.

—The following, from *Nature*, will interest our readers:—

On Tuesday afternoon [Feb. 5] at Oxford, convocation witnessed in the Sheldonian theatre the most exciting scene that has been enacted in the university since the opposition to Dean Stanley as select preacher. Last summer convocation passed by a small majority a vote of ten thousand pounds for a new physiological laboratory. The vote was opposed by the anti-vivisectionists, and by some on the ground of economy. A memorial got up by Mr. Nicholson against vivisection having produced no effect on the council, the opponents of Professor Burdon Sanderson determined to oppose the decree brought before convocation on Tuesday for empowering the sale of stocks for the ten thousand pounds voted last

June. The decree was supported by the dean of Christ church, Dr. Acland, and the warden of Keble, and was opposed by Professor Freeman and Mr. Nicholson. After a stormy debate, the vote was carried by a hundred and eighty-eight votes against a hundred and forty-seven. The result was received with enthusiasm, and Oxford is to be congratulated on it. To what shifts Dr. Sanderson's opponents were put may be seen from what the *Times* calls 'the most astonishing speech' of Mr. Freeman the historian, "who afforded a curious example of the confusion of thought into which even intelligent men may be led by an over-indulgence in sentiment. It would be as reasonable, said Mr. Freeman, for the historian to illustrate the festivities of Kenilworth by an actual bull-baiting, as for the physiologist to experiment upon living animals. Mr. Freeman, in his zeal to establish the scientific character of the historian, forgets the difference between description and discovery, and ignores the fact that the physiologist, at least under the existing law, makes his experiments, not for the instruction of pupils, but with a view to discover what is as yet unknown. A more curious article in the indictment against vivisection we have not met with since the celebrated letter in which Sir George Duckett told the royal commission that he had no evidence to give, but that he considered vivisection 'an abomination introduced from the continent, going hand in hand with atheism.'" The *Times*, in its leader on the subject, treats it sensibly and moderately. "All those who are open to argument have been long ago convinced that Science cannot proceed on her beneficent way without the aid of experiments, some of which must be painful; and those who are not open to argument, and those who believe, like some of the wiseacres whose opinion is on record, that 'medical science has arrived probably at its extreme limits,' are not likely to be convinced by any thing that can be said or by any facts that can be brought against them. Parliament, on the recommendation of one of the strongest royal commissions ever appointed, has legislated in the matter, and physiological experiment is now under limitations as severe as it is possible for it to be consistently with any kind of progress in discovery. Abuses are of the rarest occurrence. Men like Dr. Sanderson are not only humane, but they are conscious that public opinion is awake on the matter; and their discretion as to what should be done, and what should not, is absolutely to be trusted. It is to be hoped that the sensible action of convocation will not only encourage the Waynflete professor to proceed as his scientific conscience may guide him, but will convince the well-meaning but irrational opponents of scientific freedom that further action on their part would be not only vexatious, but unsuccessful."

—Professor Nehring has reported to the Berlin anthropological society the discovery, in a cave near the village of Holzon in Brunswick, of bones which show proofs of cannibal practices. It is the first evidence discovered, that a race of anthropophagi ever existed in Germany. The bones were not fully calcined,

and had evidently been chopped to obtain the marrow. As a still greater proof of cannibalism, it was shown that the bones were thrown in a heap, as if cleared after a meal. Other objects of interest, such as rough bronze ornaments, were found in the cave; and, on excavating a lower stratum of the floor, bones of animals of the glacial period were found, showing the existence of the cave at that time. In the subsequent discussion, Professor Virchow raised some objections to the cannibal theory.

—A society with Dr. C. F. Millsbaugh as president has been formed at Binghamton, N.Y., under the title of the Erosophian microscopical society. It has some forty or fifty members.

—*Papilio*, on its removal to Philadelphia, no longer appears as 'the organ of the New York entomological club;' but in other respects it does not differ noticeably, as the new editor, Mr. Aaron, has evidently endeavored to preserve the character of the journal, even to typographical details. As is fitting, considering its name, it is still 'devoted exclusively to Lepidoptera,' and renders the lovers of those insects good service.

—A memorial volume of the scientific papers of the late W. A. Forbes, at the time of his death prosector of the Zoological society of London, is to be published, through a committee consisting of Professors Flower and Bell, and Messrs. Johnston, Mivart, and Sclater, at the price of one guinea. Mr. Sclater will edit the volume, Mr. Johnston will add a biography, and Mr. F. Jeffrey Bell (5 Radnor Place, Gloucester Square, London) will act as secretary and treasurer.

—In his presidential address before the Biological society of Washington, on "Certain phases in the geological history of the North-American continent, biologically considered," Dr. C. A. White shows how important to a knowledge of the evolution of the continent is a study of terrestrial and fresh-water faunas and floras of geological times.

—Dr. C. B. Reichert, for many years director of the anatomical museum at Berlin, died in that city, Dec. 21, 1883.

—Prof. H. Carvill Lewis, A.M., recently appointed lecturer on geology and paleontology at Haverford college, gave his first lecture last week Wednesday, upon 'The foundation-stones of Pennsylvania.' This week's subject was 'The ancient life-history of the Chester valley;' and in following weeks 'The origin of the Pennsylvania mountains,' 'Volcanic action in Chester and Montgomery counties,' 'The geology of Haverford and its vicinity,' 'The glacial epoch in Pennsylvania,' will be treated. The lectures are open to the public.

—The seventh Saturday lecture in the National museum was on Feb. 16, by Prof. E. D. Cope, on the 'Origin of human physiognomy and character,'—a discourse the main features of which have already been published in the *American naturalist*. On Feb. 23 Mr. John Murdock, late of the signal-service party at the Oglala station, North Alaska, gave a very vivid account of 'Eskimo life at Point Barrow.'